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March, 1924

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The Philippine Agriculturist

(University of the Philippines Publications: Series A)

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The
Philippine Agriculturist

VOL. XII, NO. 10 MARCH, 1924

HOG RAISING FOR BEGINNERS[1]

By B. M. Gonzalez
Of the Department of Animal Husbandry

WITH ONE TEXT FIGURE

Pork is the staple meat food in the Philippines. While the use of chickens is more widespread, yet the consumption of pork in kilograms is vastly greater than that of poultry; and there is no meat that is more relished by the Christian Filipinos.

Interest in hog raising has increased steadily the past decade, and this has brought to the army of hog raisers a body of recruits who have had to learn their lessons by experience. We have been confronted from time to time with demands for information on the subject and it is in response to such requests that this article is written. Hog raising is not so easy an undertaking as is imagined by many who have never tried it. The writer does not presume nor will attempt to cover the whole subject in this necessarily brief article, but if he succeeds in giving some information on the subject that will be of value to the beginner and will stimulate him to think about and to study and appreciate the problems that will confront him, he will have attained his purpose.

So many young people, and older ones too, desire to raise live stock to "get rich quick." Such persons will likely be disappointed if that is all their equipment for their undertaking. Animal industries concerned with the actual production of live stock have never paid big dividends until time has passed and hard work has been put in them. Men with the idea of quick returns will do better in the utilization end of the live stock industry, that is, animal trading and slaughtering, than in production.

The production of live stock is a steady enterprise and requires patient work to make it a success. It is a business for the home lover who is content with an independent and moderate living and is willing to work hard for it. It is not a business for the capitalist. There are so many little pitfalls connected with the industry that it takes the personal attention of the owner, himself, to see them.

HOW TO BEGIN

The beginner would do well to start hog raising on a small scale, rather as a side line to his usual occupation, and as he learns the details of the business he can determine to what extent it is profitable for him to expand. Three hectares of land and ten sows is as large a beginning as one new in the business should

[1] Experiment Station contribution No. 224; Circular No. 1.

attempt. He can start on much less than this, but there might not be enough in it to keep his attention.

The beginning hog raiser should plan his grounds in such a way that they may be divided into lots about equal in size. This division is to enable him to rotate pastures; also to plant a crop of corn once in a while and utilize the fertility accumulated in the land through the manure of the hogs, and to bury by plowing a great multitude of parasites which pollute the ground after animals have been kept on it for some time.

He should establish a central hog house easily accessible from all the lots. The central hog house is most useful during farrowing time. In it may be kept hogs about to farrow so that those needing attention may be close by, and the little pigs will be under favorable conditions for proper development. Each compartment in the hog house should be about 2½ x 2½ meters and there should be allowed an average of one compartment for every two sows kept in the herd. The size of the house will, of course, depend on how many sows one desires to keep. The floor of the house should be of concrete that it may be dry, sanitary, and easy to clean. The sides may be made of bamboo or lumber. The roof may be of nipa or tile. Lumber siding on a concrete foundation will last longer than bamboo and will prove more economical in the end. The roof should be set low enough to afford protection from driving rains so the sides need not be higher than is necessary to keep the hogs in the compartments.

It is possible to keep hogs in the Philippines without any provision for housing. The weather is mild throughout the year and the pigs can be left in the open where there are trees here and there to protect them from the heat of the midday sun. The house, while not indispensable, is very convenient, however, as it furnishes a central place for the different events and operations in connection with the running of the plant, as in farrowing, castrating, catching for the market, isolation of sick pigs, breeding, mixing feeds, feeding, etc. Without a central house the yard or grounds, where feeding is done, is likely to be muddy and very insanitary as well as inconvenient for work.

When the hogs are pastured in the fields, they should be given shade. If there are large trees no further provision is necessary. If there are none, a framework covered with palm leaves gives sufficient protection from the heat of the sun.

SELECTION OF STOCK

It is best to look around in the neighborhood for a prolific mother and contract for as many of her female pigs as are desired before they are weaned. If the selection is delayed, it is more than likely that the pigs will be sold for *lechon* (roast suckling pig) as there are few of the poorer families that can afford to bring up to maturity a large litter of pigs. Also it is cheaper for the beginner to buy the pigs while very young, and this is a good age of stock for him to learn his first practical lessons in pig raising. The pigs selected should be from a mother of fair size and with ten to twelve pigs to the litter. A sow with less than eight pigs cannot be considered as prolific. The advantage in having prolific sows is that one does not need to keep so many to produce the pigs needed. For example, if one intends to feed to maturity fifty pigs, he will need to keep ten sows if the average number in a litter is only five, but if they bear ten pigs at a time, then he needs to keep only five sows. He will therefore save a large amount of

money as he will be feeding only five sows instead of ten to produce the same number of pigs. The boar should be a pure breed, a Berkshire for example. The progeny of such a boar out of native sows are called *grades*. They are generally better looking than pure native pigs, grow faster, fatten quicker, and are much tamer. Also grade pigs are not very susceptible to disease.

IMPORTED BREEDS

Several imported improved breeds have been brought into the Islands from time to time, such as the Berkshire, the Duroc Jersey, the Poland China, the Tamworth, and the Yorkshire. None of these breeds has been found to be fully adapted to Philippine conditions, that is, climate, feeds and the native method of hog raising. As they have a tendency to grow fast, they require more feed at each meal to keep them in good condition, much more than is generally given the native pig, and better balanced as to its nutrients. In return for this extra feed they produce pork correspondingly faster. However, there are many disadvantages with these improved breeds: (a) They are not so prolific as native hogs, often averaging no higher than five pigs to each litter and frequently even fewer; (b) They are susceptible to a number of diseases which have apparently little effect on native pigs, as kidney worms and round worms; (c) Even those that are able to endure these diseases longer do not usually live beyond two years and a half. It is rare to find pure bred pigs in the Philippines older than three years. (1)

For the present, then, it is not recommendable to raise pigs higher than 50 per cent of some pure breed. As stated above, such grades have been found by experience to be almost as easy keepers as the native pigs and return better profits. They are good market pigs.

As to which of the pure breeds enumerated above is the best to get a boar from, there is little difference. All in all, the Berkshire and the Duroc Jersey are the most recommendable for the Philippines at present. A brief statement of the characteristics of these breeds follows.

The Berkshire.—This is one of the oldest breeds of hogs and is very popular in the Philippines, especially the individuals with short up-turned snouts. The Berkshire is black with six white points at the face, at the four feet, and at the switch of the tail. With pure black native pigs the grades, or *mestizos* are colored much like the father. With black and white spotted pigs some of the young are almost pure black while others are spotted much like the mother. While not very well suited to the Philippines, the Berkshire among improved pigs is probably the best adapted to our conditions.

The Duroc-Jersey.—This is an American breed that is of comparatively recent origin. Its color is solid red, varying in shade from light to dark. It has a longer and more pointed snout than the Berkshire. It has proven about equal to the Berkshire in its adaptability to local conditions.

The Poland China.—This breed is also American derived in part from the Berkshire. It has more quality and fattens easier than the Berkshire, but is not so hardy. Its color is the same as the Berkshire. Its face is straight, rather than dished like the latter. It has not proven very hardy in the Philippines.

The Tamworth.—This is an English breed of red pigs colored somewhat like the Duroc-Jersey. It is a bacon breed and the form of its body is long, tall and thin, not like that of the other breeds mentioned, which is short, broad, and com-

pact. It has a long snout and stands on long legs. Due to these characteristics and the form of its body, it is not popular in the Philippines, as the people see a great similarity between it and the wild hogs.

The Yorkshire.—This is an English breed of white hogs. They have been imported into the Islands rather recently and have therefore no reputation established, either good or bad. They seem to be doing well, so far. Their color is a great drawback to them in this climate. White skin blisters easily under the heat of the sun. They are also difficult to keep clean. Its grades with native pigs are white, but as most native pigs are black, the offspring with this breed after the first generation are bound to lack uniformity in color.

Boars of the breeds named above may be purchased from the Bureau of Agriculture for about ₱30 at about weaning age; if older, the price is more.

MANAGEMENT

WHEN TO BREED

Native pigs that have been fed properly will generally take the boar when about 10 months old. It is a good plan to breed the sows at this time. Age is only an approximate guide, however, as more depends on the development of the animal. Well grown animals may be bred earlier, while slow maturing and inadequately fed animals may not be ready to breed until much later.

THE SOW

If a sow farrows not more than six pigs and proves to be a poor mother, she should be fattened after weaning her pigs and sold or butchered. If she farrows about eight or more and raises them well, then she may be kept longer. The second litter is likely to be larger than the first. Sows that have proven to be good mothers should be kept as long as possible, as they are better capital than unknown young sows.

If the sow and her brood are fed and cared for properly, the sow may be bred soon after weaning her litter and thus produce two litters in one year. In practice, however, three litters in two years is about all that may be expected.

The pregnant sow may be allowed to run with the rest of the herd. She should have sufficient feed, however, to properly develop her young pigs as well as store some fat which will serve later as reserve in nursing the growing pigs when born. At this time she can have rice bran, or *tiqui-tiqui*, and some corn. She should be allowed to graze and in case she cannot be conveniently turned to a grassy lot she should be given green forage. Stalks of peanuts will be very valuable for this purpose. Any other legume that the animal will relish will be equally as satisfactory.

Knowing when the sow was bred, count 112 days ahead, and it will not be many days away from that when the sow will be ready to farrow. Native sows will generally steal away at that time and make their nest in some secluded place where they will not be molested. If one has a hog house, after cleaning it thoroughly the sow should be confined in it before farrowing. She may be given rice straw or clean dry banana leaves for nesting material. The sow is likely to miss one or two meals at this time which should cause no alarm. She should be given plenty of water.

THE PIGS

When about four weeks old, the little pigs will begin to taste the feed of the mother and will gradually eat more and more every day. They should be encouraged to do this, as they will grow faster; the feed should be increased accordingly. The pigs may be weaned when 10 to 12 weeks old.

NUMBERING

To identify the pigs, and to keep a proper record of their ancestry and their age, a system should be followed. The one shown in the illustration is widely used by hog men and is very satisfactory. Notches are cut on the pig's ears with a sharp knife as follows:

1 = notch on lower edge of right ear
10 = notch on lower edge of left ear
3 = notch on upper edge of right ear
30 = notch on upper edge of left ear

If one desires any number, all he will have to do is to combine any two or more numbers. For example: 2 will be indicated by making two punches on the lower edge of right ear; 16, by notching the lower edge of the left ear once and the upper edge of the right ear twice, and so on. In case he has exhausted the numbers, then he may start from number 1 again. By that time the earlier numbered pigs will have been mostly disposed of, and the few that remain may be easily distinguished from the younger ones of the same number.

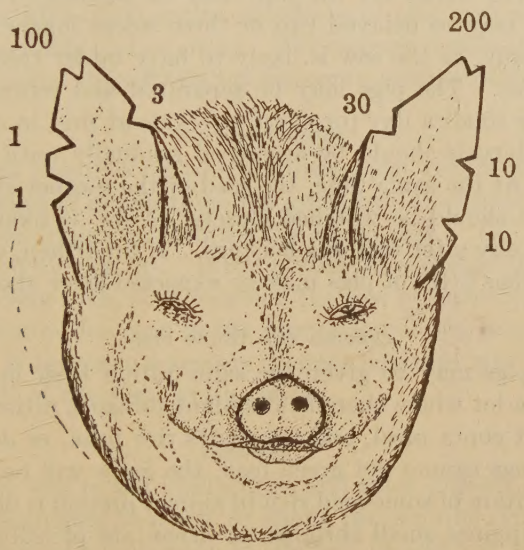

Fig. 1.—Diagram showing a system of numbering pigs by means of notches on the ears

CASTRATION

Young males not desired for breeding should be castrated as early as possible. The older the animal the more he resents the operation. Vigorous pigs may be castrated when about six weeks old. At this time they scarcely notice the operation. When delayed until after weaning they generally suffer more from it as weaning itself causes them considerable disturbance. The operation is very

simple and may be performed with any size of pigs. The danger increases, however, as the size of the pig increases. An attendant catches the pig and holds him on his back on a box or bench and exposes the scrotum. It is then washed thoroughly with a piece of cotton or clean rag dipped in some antiseptic solution, as 3 per cent creolin or carbolic acid. The attendant disinfects his hands, and with a sharp knife cuts a longitudinal incision and exposes one testicle. The testicle should be freed of the membranes and these be allowed to retract. The cord is then pulled steadily but not too strongly. Then with a dull, and preferably nicked but clean knife, the cord is cut. If only a sharp knife is available, the cord should be scraped with it instead of cut, as cutting will cause profuse bleeding. The operation is repeated on the other testicle. The incision should be long enough to insure good drainage. It need not be sewed up after the operation as it heals better without. After the operation, rub a mixture of vaseline and tar on the wound to keep away the flies. The newly castrated pigs should be turned on a clean cement floor or on a dry clean grass lot until their wounds are fairly well healed.

Ruptured pigs, that is, pigs in which the intestines are able to pass into the scrotum, are more difficult to handle. Their castration should be left to a trained operator. It is preferable that these be sold when young for *lechon* rather than to run the risk of losing them in castration.

WEANING

When about ten weeks old the pigs may be weaned; if they are not very vigorous, weaning may be delayed two or three weeks longer. Weaning should not be done suddenly, as the sow is likely to have udder trouble if her pigs are removed all at once. The pigs may be separated and returned to the mother about two or three times a day for short intervals at first in order to empty her udders. These intervals should be decreased gradually until complete weaning is accomplished. At the same time, the feed of the mother should be decreased considerably. She should be watched closely, as she is likely to come in heat at about the third day after weaning her pigs. If bred then, conception is likely to follow and another litter of pigs may be expected after about 112 days.

FEEDING THE YOUNG PIGS

The weaned pigs may be given the same ration their mother was getting. If the pigs are on a lot where there is abundant forage a ration consisting of one part corn, one part copra meal, and two parts rice bran, or *darac* will be found satisfactory. If pigs cannot get green feed, the gains will be much slower. At such times the addition of some feed rich in animal protein is desirable. In many places in the Philippines small shrimps, or *hipon* are plentiful. These may be given in the proportion of 10 per cent of the total feed if fresh, or 5 per cent if dried. When the pigs reach six months of age they will need the animal protein feed less. The pigs then may be fed more corn in proportion.

COMMON PHILIPPINE FEEDS

CORN

Corn is a fattening feed, and should not be given in a higher proportion than one third of the total feed for brood sows, boars, and young pigs. For fattening pigs as much as two thirds of the ration may be corn. When pork retails

at ₱1.00 a kilogram, corn cannot be fed profitably if it costs more than ₱6.00 a cavan (58.5 kg. shelled), or ₱1.20 for 100 medium ears, or 10 centavos a kilogram, shelled.

RICE BRAN, (DARAC, OR TIQUI-TIQUI)

Rice bran is a fattening feed, also, but has laxative effects. For growing pigs, brood sows, and boars, as much as two thirds of the grain ration may be rice bran. For fattening pigs more than one third of the ration should be *darac*. There are two kinds of *darac*, or *tiqui-tiqui* in the Philippine market. One comes from small combination mills which hull and polish the rice all in one process so that the by-product is a mixture of hulls, bran, and broken grains, or *binlid*. The other comes from larger mills. In these, the hull is kept separate and there is less broken grain mixed with the bran. The first kind has very poor feeding value and is worth only about one half of the bran from the larger mills yet its price is often two thirds as much. The bran from the large mills is the kind to be purchased. It has a feeding value that may be placed conservatively at from 10 to 25 per cent more than the same weight of corn. (2) When pork sells at ₱1.00 a kilogram one cannot afford to feed rice bran higher than ₱2.85 a cavan of about 26 kilograms, or 11 centavos a kilogram.

COPRA MEAL

This is a comparatively abundant as well as cheap feed in the Philippines. Not more than one third of the ration should be of this feed, and preferably less, if other feeds are available and as cheap. When pork retails at ₱1.00 a kilogram one should not pay more than ₱84 a ton for copra meal or 8 centavos a kilogram.

SWEET POTATOES

A field of sweet potatoes on which growing pigs can be turned to forage is one of the easiest ways of giving them the green feed they need. Sweet potatoes grow well all over the Islands and during the whole year. The leaves, as well as the roots, are relished by pigs (3). If not pastured too closely the tubers will grow continuously for a long time, thus reducing the cost of replanting. Sweet potato tubers can be substituted for corn in the proportion of 3½ kilograms sweet potatoes to 1 of corn. If the price warrants it sweet potatoes may be substituted for as much as one half of the total grain ration.

COWPEAS

This crop grows well in the Philippines, and when pigs are turned to it at the time the pods are beginning to ripen, or about two months after planting, it furnishes a rich nitrogenous supplement to the feed in addition to its forage value. While the plants keep on growing even after the pigs are turned on the pasture, they are killed after a while and replanting is necessary (2).

CORN FORAGE

Standing corn makes a good feed if pigs are turned in at about the time the grains are beginning to turn hard, or shortly after the roasting stage. The pigs will save labor by doing the harvesting themselves, and will make comparatively large gains. They will consume the corn in this way, however, much faster than if the corn was given to them in the feed lot, and the gains are comparatively more expensive.

Approximate maximum price that should be paid for feeds when pork sells at ₱..... per kilogram.

Price of pork.	₱0.50	₱0.60	₱0.70	₱0.80	₱0.90	₱1.00	₱1.10	₱1.20
Feeds								
Corn:								
Shelled, per kg.	.05	.06	.07	.08	.09	.10	.11	.12
Shelled, per cavan.....	2.90	3.50	4.10	4.70	5.25	5.85	6.45	7.00
Ears, medium per 100....	.60	.72	.84	.96	1.08	1.20	1.32	1.44
Rice bran:								
(Good grade) per kg.	.05	.07	.08	.09	.10	.11	.12	.13
Per cavan of 26 kg.	1.43	1.72	2.00	2.30	2.58	2.87	3.14	3.44
Copra meal:								
Per kg.	.04	.05	.06	.07	.07	.08	.09	.10
Per ton.....	41.50	50.00	58.50	66.50	75.00	84.00	92.00	100.00

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LEAF BLIGHT OF CORN[1]

By Severo Marquez

Leaf blight is one of the most common diseases of corn (*Zea mays* L.) in the Philippine Islands. Field plants of all varieties always show the symptoms of the disease. Introduced varieties are usually severely attacked. The Filipino farmers do not consider the disease to be harmful so give it no particular attention.

THE DISEASE

GEOGRAPHICAL DISTRIBUTION

According to Butler (1) leaf blight of corn is the most common disease in many parts of India and the only disease that has been observed every year to a greater or less extent at Pusa. It was first described in Italy in 1876, and has since been reported in the United States, South Africa, Japan, and the Philippines. Robinson (2), reported that in some parts of the United States the leaf blight fungus was found severe and destructive as far back as 1889.

According to Hunt (3), a leaf blight of corn produced by *Helminthosporium gramineum* (Rab.) Erik. was found in America in 1907 causing extended, brown, and elliptical dead areas on the leaves. Stevens and Hall (4) also in America, reported in the year 1910, that leaf blight of corn gives a somewhat frost-bitten appearance to the leaves, with a thin green-olive mold on the lower sides. Reinking (5) first found the disease in the College of Agriculture at Los Baños, Philippine Islands. In the year 1918, Reinking (6) also found the same fungus on corn plants in China.

ECONOMIC IMPORTANCE

In north-eastern United States *Helminthosporium* causes much loss (2). Serious damage has also been recorded from the fungus in Italy.

Reinking (5), found that entire plots of sweet corn were destroyed by leaf blight. In order to determine the severity of the disease, twenty different varieties of corn planted in the College of Agriculture were observed and the degree of infection noted. It was found that Montellano's Corn, Yellow Flint, Chinese Waxy Endospern, Fenchy Salvador, Laguna Mexican, Mismis, and the Los Baños White were slightly attacked. Mexican June Corn, Moro Corn, Early Flint Sweet Corn, Señora, *Zea mays indentata*, *Zea mays everta*, Argentina Pop Corn, Yellow Flint, Cebu White Flint, Guam Corn Flint, and Bolero F had medium infection. White Pearl, Guam White Dent, Forlorn, and the Country Gentleman Sweet Corn were severely infected. In general the native varieties were slightly infected by the fungus.

SYMPTOMS OF THE DISEASE

EARLY STAGE OF INFECTION

The early stage of the disease on the field corn plants is characterized at first by minute yellow roundish spots on the leaves, which gradually increase in size,

[1] Thesis presented for graduation from the College of Agriculture, No. 174. Experiment Station contribution No. 225. Prepared in the Department of Plant Pathology under the direction of Professor Otto A. Reinking.

generally becoming somewhat oval in shape. As the spots become older, their long axes run parallel to the veins of the leaves. They elongate into stripes. The spots may run together forming a large spot and may cover the entire leaf surface. In the inoculated plants the first symptoms of the disease are spots on the leaves with water-soaked borders. They increase in size, become yellowish in color, and finally turn brown.

ADVANCED STAGE OF INFECTION

When the spots are old, they have light yellowish to gray centers around which is a brownish colored tissue. A black mold composed of conidiophores and conidia is produced in the center of the old spots. This is visible to the naked eye.

CAUSAL ORGANISM

METHOD OF ISOLATION

A young diseased portion from the leaf of corn was cut off with a pair of scissors and disinfected with a 1 to 1000 mercuric chloride solution for thirty seconds. Then it was washed three times with sterile water in test tubes to remove the disinfectant. Finally, it was transferred to the potato agar in sterilized petri dishes by means of a sterilized platinum needle. After one day a white growth of mycelium was noted around the leaf section of the agar in the petri dishes. A portion of the mycelium was transferred to a test tube with potato agar. The cultures were transferred twice a month to other test tubes.

MORPHOLOGY

Mycelium.—The mycelium grows very abundantly in masses. It is septate, slightly constricted at the septa, branched and somewhat granular. It is hyaline when young and light brown when old. Twenty cells of the mycelium were measured and they were found to be 18-40 microns x 4-6 microns.

Conidiophores.—The conidiophores arise in clusters. They are pale in color in the earlier stage of development and yellowish brown when old. They can be easily distinguished from the mycelium. They are septate, and somewhat granular. Twenty conidiophores were measured and these were found to be 96-148 microns x 8-10 microns. Each conidiophore varies from 4 to 8 cells depending upon the age.

Conidia.—The conidia are borne at the tips of the conidiophores. The conidia are wider at the middle and gradually taper toward the two ends. They are septate, and are crescent-shaped. Two hundred spores were measured and these were 36-112 microns x 10-18 microns.

The results of the measurements of conidia made by the writer are very similar to the result obtained by Stevens (7). The writer found that the conidia are 36-112 microns x 10-18 microns. Stevens (7) found that the conidia were 80-120 microns x 20-24 microns. The writer is therefore of the opinion that the species causing leaf blight of corn in the Philippines is *H. inconspicuum* Cke. and Ell.

PHYSIOLOGY

On September 1, 1920, four different kinds of culture media were prepared in the laboratory. On September 2, 1920, these media were inoculated with the conidia of the fungus taken from the pure culture previously prepared. Daily observations for fifteen days were made after the transfer of the fungus to the media.

Growth on potato agar.—The growth of the fungus on this medium was faster than on any of the other three media used.

Growth on sterilized potato cylinders.—At the end of fifteen days the fungus was as black as the culture on potato agar; it ranked second with respect to growth.

Growth on sterilized corn stalk.—The growth on the corn stalk was less pronounced than the growth on potato agar and sterilized potato cylinders. After fifteen days it was as black as the growth on potato agar and potato cylinders.

Growth on sterilized bean pods.—The growth of the fungus on the bean pod was the slowest. The whole pod was thinly covered by the fungus. The fungus did not turn as black as the growth on the potato agar, potato cylinders, or corn stalk.

RELATION OF SPORE PRODUCTION TO MEDIA

On the tenth day after the transfer of the pure culture of the fungus to potato agar, potato cylinders, sterilized corn stalk, and sterilized bean pods a microscopic examination of the fungus taken from each culture medium was made. Spores were found in the cultures grown on the four media used. It was found that spores were formed after seven days on potato agar in the previous cultures.

GERMINATION OF SPORES

Three trials were made in germinating the spores or conidia of the fungus. The first trial was made July 20, 1920. A small mass of conidiophores and conidia taken from the pure culture was mounted on a glass slide and put under the microscope. In the first trial it took 15 hours for the conidia to germinate. The second trial was made on July 22, 1920. In the second trial it took three hours for the spores to germinate. The third trial was made on the same day as the second. Conidia were found germinating after two hours.

LONGEVITY OF THE SPORES

Twenty-four leaves of corn severely infected with *Helminthosporium inconspicuum* were gathered in the field. Twelve of these leaves were kept outside of the laboratory, exposed to rain and sun, and the other twelve were kept in the laboratory. The experiment was started on October 19, 1920, and closed on January 25, 1921. A few spores were taken from the two specimens at three-day intervals until the spores were found not viable.

The writer found that the spores taken from the specimens kept outside contained more viable spores over a longer period than those kept inside. Of the 34 trials made, the last four for the specimens kept inside, and the last two for the specimens kept outside, gave no germination. The specimens that were kept outside remained viable for a longer time than those kept inside. In both cases, the spores were found still viable three months after the specimens had been gathered in the field. The specimens which were kept in the laboratory, not being exposed to moisture, did not live as long as those kept outside. From this, the writer concludes that moisture favors the germinating power and longevity of the conidia. The specimen which was kept in the laboratory was still in a good condition when the experiment was closed, but the conidia were not viable. The specimens kept inside showed no germination nine days before the outside specimen ceased to germinate.

PATHOGENICITY

To test whether the isolated fungus from the leaf spots of corn would cause trouble similar to the spot in the field inoculation, experiments were made. Plants grown in the laboratory and in the field were inoculated.

Conidia from a pure culture of the fungus was transferred from a test tube of potato agar to the atomizer with sterilized water by means of a platinum needle. The plants were sprayed with the conidial suspension in a very fine mist. They were then covered with bell jars on the table in the laboratory. Daily observations were made both on the inoculated plants and on the control.

According to the observations made, the spots were formed on the leaves of the plants in the laboratory on September 16, 1919, one day after the inoculation of the potted plants. On September 18, 1919, three days after the inoculation of the plants in the field, a few minute yellow specks were observed on the plants. Spots with water-soaked borders were first observed on the potted plants, while a slight yellowing in the form of spots was found on the corn plants inoculated in the field. The plants grown in the field showed signs of the disease two days later than those which were grown in the pots. This was probably because the plants in the laboratory were more tender than those grown in the field. The control was not infected. In order to be sure that the fungus was the real cause of the disease, re-isolation was made from both the inoculated plants in the laboratory and in the field. In both cases a fungus similar to the original one was obtained. The method employed in the re-isolation experiment was the same as that employed in the isolation experiment.

On August 18, 1920, twelve small pots with soil were sterilized in the autoclave, and five seeds of corn were planted in each pot after the pots had been sterilized and cooled. The seeds were disinfected with a 1 to 1000 mercuric chloride solution for thirty seconds before they were planted. The pots were divided into three lots, each lot having four pots. The soil in the first four pots was inoculated with the pure culture of the fungus before the seeds were planted. The plants in the second four pots were inoculated after the seeds had germinated. The last four pots were used as the control. All the pots were covered with bell jars on a table in the laboratory. Daily observations were made on the three lots till the end of the experiment.

It was found that the plants from the inoculated soil were infected two days after the seeds germinated. The plants whose leaves were sprayed with conidial suspension were infected a day after they had been inoculated. The control plants remained healthy. The results show that the fungus in the soil can infect the plants after they have germinated. The spots in both lots turned yellow in color. Some of the infected leaves in each lot were cut and decolorized in a solution of acetic acid and alcohol. The decolorized leaves were mounted in glycerine on glass slides and the conidiophores and conidia were observed in the corn leaf tissue.

METHOD OF INVASION

It was found that the fungus entered through the stomata, and directly through the leaf tissues.

DISCUSSION OF RESULTS

It was found from observations made on the twenty varieties of corn used that six varieties were slightly infected by the fungus, ten varieties showed me-

dium infection, and four were severely infected. The native and acclimatized varieties were slightly infected while the imported new varieties were severely attacked.

It was found that the early symptoms of the disease were the presence of watery spots on the leaves in case of the plants grown in the laboratory, and yellow spots in the case of the field plants. In both cases the spots increased in size, turned yellow and then brownish. The old stage of the spots was covered with black mold which was composed of conidiophores and conidia.

In the study of the causal organism, it was found that the fungus grew very well on potato agar. Through the isolation experiment it was noted that the growth of mycelium on potato agar one day after the transfer of the diseased part was very evident. The infection experiments showed that the fungus grown in pure culture readily infects the corn plants. The plants grown in the laboratory were more susceptible to the fungus than those grown in the field. As shown by the decolorized leaves taken from the inoculated plants, the fungus enters through the stomata and through the leaf tissue by directly penetrating through it. It was also observed that the corn seeds disinfected with 1 to 1000 mercuric chloride solution, and planted in sterilized soil were free from the fungus provided that they were kept in a controlled condition. Soil inoculation also showed that the spores in the soil may infect the young plants.

Morphological studies showed that the organism had one type of spores which vary in dimensions and in number of septa.

Butler (5), Stevens (6), and the writer obtained different measurements of the spores of the organisms which they studied. The writer's result, however, was more nearly like that obtained by Stevens, so that the organism is to be referred to *Helminthosporium inconspicuum.*

The organism grew best on potato agar. Bean pod was a poor substratum for this fungus, because its growth on this medium was very slow. When mounted in water the conidia germinated within two hours at 31°C, producing one or two germ tubes, one at each end. The spores were found still viable three months after the specimens had been gathered from the field and kept in the laboratory, and it is very probable that they may remain viable even for a longer time. The diseased parts do not decay when they are kept from moisture and they last longer than those exposed to moisture, but in case of the viability of spores it is better for the spores to be exposed to weather conditions. Spore-catching experiments showed that the spores are probably blown by the wind. Further work however needs to be done on this phase of the problem.

SUMMARY OF CONCLUSIONS

(1) Leaf spots caused by *Helminthosporium inconspicuum* were found on all varieties of corn planted in the College of Agriculture.

(2) Imported varieties are more susceptible to the fungus than the native and foreign but acclimatized varieties.

(3) Spores and conidiophores are formed on the older spots.

(4) Plants grown in the laboratory are more readily infected by the fungus than plants grown in the field.

(5) The fungus enters through the stomata of the leaves, and by direct penetration through the leaf tissues.

(6) *Helminthosporium inconspicuum* produces one type of spores which vary in size and number of septa.

(7) It was found that the older leaves of the plants grown in the field were severely infected.

(8) Conidia and conidiophores germinate by means of germ tubes, the conidia producing one or two germ tubes, one at each end of the conidium.

(9) The spores may germinate within two hours in a drop of water at 31°C. room temperature.

(10) The conidia remained viable as long as three months when kept in the laboratory, and as long as seven months from the time the plants were infected to the time that the conidia lost their viability.

(11) The spores in the soil may infect young corn plants.

(12) The wind is probably a means by which the spores are carried from one corn plant to another.

(13) White Pearl, Guam White Dent, Forlorn, and Country Gentleman sweet corn were the varieties severely infected by the fungus in the College of Agriculture.

RECOMMENDATIONS

The recommendations herein formulated are based on observations and from the results of the experiments.

(1) It is recommended to practice crop rotation, because the spores in the soil may infect the corn plants when planted in a field where corn has just been harvested.

(2) If possible, plant only resistant varieties of corn. Native and acclimatized foreign varieties are to be preferred.

(3) Imported varieties should be planted in isolated fields.

(4) Manure or compost made from leaves on diseased fields should not be used as fertilizers for corn.

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STUDIES ON PHILIPPINE POULTRY FEEDS I: AVAILABILITY AND PALATABILITY[1]

By Nicasio A. Tuason and F. M. Fronda

Perhaps, of all the factors that control production, feeding is by far the most important, as about sixty per cent of the cost of production is traceable to feeds. In the art and science of poultry feeding, there are many factors that should be considered, but ranking in their order of importance, the availability and palatability of the feeds head the list.

So far no studies have been made along these lines in the Philippines, although of the many obstacles that tend to discourage poultry raisers in the Archipelago, the lack of information on the proper methods of feeding is the greatest. In the United States a number of palatability tests have been conducted in several places, but as the feeds used in these studies are not the same as are used in the Philippines, the results obtained cannot be applied to our conditions.

The purpose of the studies reported in this paper was to find out the feeds, with regard to palatability and availability, best suited to our native poultry. The relative consumption of a certain feed as compared with others available to the fowls at the same time is the criterion used for palatability in this study. These studies were made from August 4, 1922, to December 29, 1922, covering a period of sixteen weeks.

AVAILABILITY

With regard to availability and price of feeds that may be used for feeding poultry in the Philippines, no experiments need be conducted. The annual statistical reports published by the Bureau of Agriculture are sufficient to show whether or not certain grain feeds can be had and fed profitably in certain localities. Usually, however, the only feeds that can be fed profitably in this country are the ones produced by the poultryman himself. A list of possible feeds that may be used for this purpose is given in Table I. This table is derived mostly from Appendix Tables I, II, and III in Henry and Morrison's *Feeds and Feeding*. The digestible coefficients for ruminants with fiber excluded were used, inasmuch as poultry cannot digest fiber. As far as such factors are available, the digestible coefficients for poultry were used. These factors were available only in the cases of cracked corn, corn meal, and potato.

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[1] Thesis presented for graduation from the College of Agriculture with the degree of Bachelor of Science in Agriculture, No. 175. Experiment Station contribution No. 225. Prepared in Department of Animal Husbandry under the direction of Doctor F. M. Fronda. With later notes and data added by F. M. Fronda.

TABLE I.—*Showing the average analysis and digestible nutrients in 100 kilograms of feeds that may be available for poultry.a*

Feeding stuff.	Total ash.	Total crude fiber.	Digestible nutrients.		
			Crude protein.	N-Free extract.	Fat.
Corn, cracked	1.5	1.5	8.9	63.2	4.3
Corn meal	1.3	2.3	7.0	64.1	3.4
Corn bran	2.4	9.8	5.8	49.9	4.6
Rice, rough	4.9	9.3	4.7	61.4	1.7
Rice polish	4.8	1.9	8.0	56.7	7.5
Rice shorts (*binlid*)	2.2	0.8	9.2	71.7	2.0*a*
Rice bran	13.2	13.6	6.9	34.1	6.3*c*
Rice meal	9.1	9.3	7.3	44.8	10.6
Sorghum	1.9	2.0	7.5	59.5	2.6
Copra meal	7.3	15.7	15.8	36.6	5.8*c*
Cowpea	3.4	4.1	19.4	51.9	1.1
Soy bean	5.3	4.3	30.7	19.3	14.4
Soy bean, fat extracted	5.4	5.3	38.1	28.7	5.0
Mungo	3.0	4.4	20.4	56.6	0.9*b*
Sunflower seed	3.1	27.9	13.5	15.1	20.3
Peanut without hull	2.2	2.6	24.1	14.7	40.4
Peanut, waste	5.4	6.2	22.0	13.0	30.1
Cow's milk	0.7	——	3.3	4.9	4.3
Whey	0.7	——	0.8	4.7	0.3
Fish meal	32.0	——	40.9	——	2.2
Dried shrimps	19.7	4.2	55.6	3.3	2.6*a*
Snails, fresh	6.1	——	7.6	7.3	0.8*a*
Fresh bone, ground	21.1	——	18.3	——	24.5
Bread	1.5	0.7	5.8	51.5	0.5
Bakery refuse	5.2	0.5	8.3	60.5	7.0
Cabbage, outer leaves	3.1	2.8	1.7	4.3	——
Mixed grasses	1.8	10.6	1.7	8.6	0.6
Potato	1.1	0.4	1.1	15.7	——

a Derived mostly from Appendix Tables I, II and III in Henry and Morrison's *Feeds and Feeding*, 1917, and from various other sources.

a Actual analysis reported by the Department of Chemistry, College of Agriculture, University of the Philippines.

b Actual analysis reported by the Bureau of Science, Manila.

c Computed from actual analysis reported by the Department of Chemistry, College of Agriculture, University of the Philippines.

Of the grains, rice and corn seem to be the most popular, as these are raised in all the provinces in the Philippines. Filipinos seem to be awakening to the possibilities of raising and using sorghum as a poultry feed. Of the ground feeds, rice bran, *binlid* (rice shorts), and copra meal, being by-products, are cheap feeds and are therefore very popular. Rice bran and *binlid* are by-products of rice, the staple food of the Filipinos, and copra meal is a by-product obtained in the extraction of coconut oil from copra, one of the principal products of the Philippines. Snails, shrimps, either dried or fresh, and refuse fish may be the principal sources of animal proteins. The use of any of these feeds, however, depends upon conditions in different localities. Cowpeas, soy beans, mungo, and peanuts can be used as poultry feeds if these can be produced cheaply. A very careful selection and combination of these feeds will aid considerably in reducing the cost of poultry feeding, which would mean greater gains for the poultryman.

PALATABILITY

Ten hens, six capons, and two roosters, making a total of eighteen fowls were used in this study. This choice of birds was used instead of any single type of poultry, so the group would be representative, hence, the results would be more conclusive. The fowls were all healthy and vigorous, and varied in age from

four months to over a year. Before starting the experiment, they were fed a ration of one part by weight each of corn and palay every morning and afternoon so as to get them acquainted with the caretaker.

In the experiment both carbonaceous and protein feeds were used in the first part, and in the second part mash mixtures supplemented with grain. The carbonaceous feeds used were corn, rice, rice bran, and sorghum, and the protein feeds were copra meal, soy beans, cowpeas, mungo, dried shrimps, dried fish, *calamismis* meal[2] and blood meal.

In the second part of the experiment, the following mash mixtures were used:
No. 1. Rice bran and copra meal.
No. 2. Rice bran and blood meal.
No. 3. Rice bran and *calamismis* meal.
No. 4. Rice bran and mungo meal.
No. 5. Corn meal and copra meal.
No. 6. Corn meal and blood meal.
No. 7. Corn meal and *calamismis* meal.
No. 8. Corn meal and mungo meal.

In the first four combinations, rice bran was the basic part, two-thirds by weight being supplied, the other constituent forming one-third. In the last four mixtures, corn meal was the basic part, two-thirds by weight, the other constituent being one-third.

The birds were housed in one of the two compartments of a College poultry house. They were provided with a grassy range about 30 by 12 meters which was divided lengthwise into two parts by a wire netting so that the fowls could be changed from one yard to another as desired, thereby establishing a rotation of yards. The feeds were placed separately in bamboo feeding troughs, and the birds were allowed to eat by the "Cafeteria style," that is, the birds were allowed to select their food and eat all they desired. Feeds were available to the birds all the time. When the birds showed a tendency to go to the same trough all the time the places of the troughs were changed. The changing was necessary about every two days. The feeds were weighed weekly. The weights of the birds were recorded every four weeks.

RESULTS AND DISCUSSION

TABLE II.—*Showing weight of the birds.*[a]

	Single feed test.	Mash-mixture test.
Number of birds	18	18
	kg.	*kg.*
Average weight at the beginning of experiment	1.36±0.049	1.58±0.068
Average weight at the middle of experiment	1.49±0.061	1.65±0.073
Average weight at the close of experiment	1.69±0.087	1.72±0.074
Gain in weight	0.33±0.100	0.15±0.104

[a] The probable errors of the means were computed according to Peter's formula.

In the single feed test the birds made an average gain of 0.33 kilogram in a period of eight weeks, thus showing that they did not underfeed themselves in this case. In the mash-mixture test the birds gained less. This lower gain seems

[2] Ground seed of *Psopocarpus tetragonolobus* L. When young, the pods make very good vegetable human food.

to indicate that the birds relished the feeds in the single feed test more than those in the mash-mixture test.

TABLE III.—*Showing amounts of feed consumed in eight weeks.*

Feeds.	Total amount.	Order of palatability.
Grains	*kg.*	
Corn (cracked)	24.6	2
Rice (rough)	34.9	1
Sorghum (whole grain)	14.2	3
Ground feeds		
Soy beans	3.6	7
Cowpeas	5.1	5
Mungo	9.4	3
Calamismis meal	1.0	8
Rice bran	4.8	6
Copra meal	6.0	4
Blood meal	0.2	9
Dried shrimps	14.7	1
Dried fish	14.1	2

In Table III is shown the total amounts of feeds consumed in the single feed test. As can be seen from this table, rice is the most palatable of the grains used in the test, corn coming next, then sorghum. Among the ground feeds dried shrimps was the most palatable, with dried fish as a close second. This order was based on the weights of the feeds, but in volume the consumption of dried shrimps was greater than that of palay, and dried fish greater than that of corn.

It was observed that on the first day, only the corn, palay, dried fish, and dried shrimps were eaten, all the other feeds remaining untouched. This choice was probably due to the birds being unaccustomed to this method of feeding. Naturally, they rushed to the feeds that they knew best or that were most palatable, leaving the less palatable and unknown feeds alone. In the following three or four days all the feeds in the troughs were consumed except blood meal, soy beans, and calamismis meal which, it may be concluded, were the least palatable. Blood meal was hardly touched at all. During the first week the birds had a natural tendency to rush to the first trough they encountered, and if they happened to like the feed found here, they remained until all of it was consumed, and then passed to the less palatable feeds and ate these in proportion to their palatability. After the first week the birds got over this habit and became accustomed to the feeds and the manner of feeding, and did not rush to any particular feed, but went from one trough to another balancing their rations. Of course the rate of consumption was in proportion to the palatability of the food as is shown in Table III.

All of the provinces produce rice, though in varying quantities. This explains the popularity of this grain as a poultry feed. As it is very palatable, it is one of the most suitable grains in the Islands for poultry feeding.

Corn, though not so extensively raised as rice, because of its wide availability and extreme palatability, is a highly desirable feed for poultry.

Although soy beans and cowpeas are not raised in large amounts there is a fairly good production in most places. These legumes are not so cheap and so palatable as rice and corn, but in places where protein-rich feeds are not available they will supply a fairly good source of protein for poultry feeding.

The palatability tests show that mungo is very palatable. As a source of protein and where it can be raised cheaply it may be highly recommended. Calamismis meal as a poultry feed is not very desirable unless other feeds are not available or when its cost is so low as to warrant its use. In combination with more palatable feeds it is consumed by poultry.

Rice bran is available in almost any part of the Philippines and is especially cheap near rice mills; although it is not very palatable it is recommended as a poultry feed because of its low cost.

Copra meal is a fairly palatable feed for poultry, though of lower rank than rice, corn, sorghum or mungo. Its use should be governed by availability, price, and supply of better feeds.

With regard to blood meal its high price and low rank of palatability make it unprofitable as a poultry feed.

In fishing localities, fish and shrimps are very often thrown away because they are not suitable for human consumption. Because of their high palatability this waste material furnishes an excellent as well as a cheap source of protein for poultry in the Philippines.

TABLE IV.—*Showing amounts of mash consumed in eight weeks.*

Mash-mixtures.	Total amount.	Order of palatability.
	kg.	
No. 1. Rice bran and copra meal	8.90	5
No. 2. Rice bran and blood meal	4.50	8
No. 3. Rice bran and calamismis meal	9.25	4
No. 4. Rice bran and mungo meal	7.60	6
No. 5. Corn meal and copra meal	14.12	2
No. 6. Corn meal and blood meal	4.80	7
No. 7. Corn meal and calamismis meal	13.25	3
No. 8. Corn meal and mungo meal	24.00	1

Table IV shows the amount of feed consumed in the mash-mixture test. It may be seen that the mixtures that had corn meal as the basal part, except No. 6, which was mixed with blood meal, were more palatable than the rice bran mixture, indicating that corn meal is much more palatable than rice bran. Of all the combinations, corn meal and mungo meal are the most palatable. Mash-mixture No. 5, ranked second, and mash-mixture No. 7, third, demonstrating that copra meal and especially calamismis meal which were found not very palatable, become palatable when mixed with corn meal.

Copra meal is not very palatable, but when mixed with some palatable feeds it was also fairly well relished by the birds.

Compared with the other mixtures, blood meal when mixed with rice bran or even corn meal was not very palatable.

As with the single feed test, during the first day the birds consumed only the most palatable mixtures, which were mash-mixture No. 8, mash-mixture No. 5, and mash-mixture No. 3, in their order of palatability. Here, also, this was adjusted as early as the fourth day when all the feeds were partly consumed, but always in relation to their degrees of palatability.

SUMMARY AND CONCLUSIONS

1. The birds made an average gain of 0.33 kilogram in the single feed test and 0.15 kilogram in the mash-mixture test in a period of eight weeks each.

These gains show that the fowls did not underfeed themselves, and that the feeds in the single feed test were more relished than those in the mash-mixture test.

2. Among the grains, rough rice was the most palatable, corn next, and sorghum third. With the ground feeds, dried shrimps was the most palatable, dried fish was a close second, mungo, third, copra meal, fourth, etc. (see Table III).

3. In the first days of the test only the familiar and very palatable feeds were touched. Later, the consumption was in proportion to the palatability, alone, of the feeds. Blood meal was practically untouched.

4. There was greater consumption of mash-mixtures having corn meal as the basic part, than those having rice bran as the basal part. This shows that corn meal is much more palatable than rice bran.

5. The mixture of corn meal and mungo meal was the most palatable, corn meal and copra meal second, etc. (see Table IV)

6. Corn meal supplies palatability to certain feed combinations, such as copra meal and calamismis meal, which when fed alone are unpalatable.

7. Mungo, whether single or mixed, is fairly palatable, while blood meal, no matter with what feed it is mixed, is unpalatable.

8. The availability of the feeds in localities and their palatability will determine which can be used profitably for poultry.

RHIZOPUS ARTOCARPI: ITS CULTURAL CHARACTERS AND ITS RELATION TO RHIZOPUS NIGRICANS[1]

By José Crisanto

INTRODUCTION

The male inflorescences and young fruits of the jak-fruit (*Artocarpus integra* (Thunb.) Merr.) are so badly attacked by *Rhizopus artocarpi* Rac. that only a very small percentage of them reach maturity. The disease produced is a soft rot.

In the Philippines the jak-fruit is not cultivated on a commercial scale but is found only in home gardens where little or no attention is given to it, hence the ravages of the fungus are serious.

Reinking, (1) gives a brief description of the symptoms of the disease and its causal organism.

In the present work, studies were made of the behavior of the fungus in the tissues of the host; the morphology of the fungus in culture and in natural infection; and the relation of *R. artocarpi* to *R. nigricans* Ehr.

MORPHOLOGY OF THE FUNGUS

DESCRIPTION OF A FUNGUS MASS OF RHIZOPUS ARTOCARPI FROM JAK-FRUIT

In the first stages of attack on the young inflorescence the fungus appears as a grayish mass which gradually becomes denser forming a black growth with black sporangia protruding. On the edge of the black growth is a whitish fringe of young sporangiophores. The mycelium is abundant over the fruit. The area covered by it rots and in time the whole fruit mummifies and eventually falls off.

The sporangia, which are black and spherical, are borne on the ends of thick, erect, more or less septate branched sporangiophores. They contain numerous spores which are liberated by the bursting of the thin walls of the sporangia when the columellae create sufficient pressure. The spores are somewhat spherical in shape and have a diameter ranging from 8.5 to 13.6 microns. In water culture at room temperature, these spores begin to germinate in about twenty-four hours. At the base of the hyphae, rhizoids are formed which serve for anchorage. These are branched and taper slightly at the ends.

Sections of the infected tissue show that the mycelial threads penetrate both intra-and intercellularly. If sections are stained with alcoholic solution of eosin, the mycelium appears a bright red, and the nuclei and granules are clearly differentiated. They penetrate the entire portions of the infected tissues. The haustoria are club-shaped and taper slightly at the tips. When a hypha penetrates a cell, a constriction is formed. The hyphae do not force their way through by mechanical action but dissolve the cell walls.

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DESCRIPTION OF THE FUNGUS GROWTH AND ITS REACTION ON VARIOUS MEDIA

The cultural characters of *Rhizopus artocarpi* were studied on four different media. The observations on the growth were made every twenty-four hours. The date of the inoculations was February 14, 1923.

Litmus milk (2).—Twenty-four hours after inoculation the color of the solution was changed from lilac to white. This change shows that the fungus develops an acid strong enough to react on litmus. The next day (48 hours after inoculation) the medium had coagulated, and a pink coloration had formed on top. So little mycelium was produced that it could not be distinguished in the medium.

Potato cylinders (3).—Twenty-four hours after inoculation, a slight growth was noticed. No sporangiophores were present. After forty-eight hours the growth was still scanty. The next day protruding sporangiophores were visible, and the growth covered the entire cylinder. On the fourth day black sporangia could be seen. Finally the potato cylinder became discolored.

Dextrose solution (4).—Twenty-four hours after inoculation, the solution changed from dark blue to reddish brown, which indicated the presence of acid. The following day the solution became clearer. On top of the solution mycelium and sporangiophores formed.

Potato agar (5).—This medium was used for stock cultures. It was observed that within twenty-four hours after inoculation whitish mycelia and young sporangiophores were visible. The next day a few sporangia appeared black. The mycelia climbed to the sides of the test tubes. The third day sporangiophores bearing black sporangia were evenly distributed throughout the entire medium. The approximate height of the sporangiophores was from four to five millimeters. The medium was not discolored. On the succeeding days the growth became abundant and the surface black. After a month it was observed that the medium turned a light chocolate color but showed no signs of disintegrating.

PHYSIOLOGY OF THE FUNGUS

EFFECT ON THE JAK-FRUIT

Natural infection.—After infection is first evident, it takes an average of four to five days to cover the fruit entirely. The rot usually begins near the stem. Under moist condition the infection advances rapidly. The stem itself is covered by the fungus.

Controlled inoculations.—The fungus develops two days after inoculation with incision and three to four days after inoculation without incision. It takes a day or two to cover the fruit with growth after the infection becomes clearly visible. The characteristic softening of the tissues and the production of sporangiophores with black sporangia take place as in field conditions. This proves the pathogenicity of the fungus. Infection of young fruits may take place through injuries caused by insects or by infection of uninjured fruits.

DISCUSSION OF RESULTS

In natural infection experiments *R. artocarpi* takes four to five days to cover the fruit with growth. The fungus is capable of infecting young healthy fruits.

In controlled inoculations, *R. nigricans* is more virulent than *R. artocarpi*. *R. nigricans* when inoculated through incisions developed signs of infection within twenty-four hours after inoculation; when inoculated without incision it de-

veloped signs of infection within two days. *R. artocarpi* when inoculated through incisions developed signs of infection within two days; when inoculated without incision it developed signs of infection within three to four days.

The growth of the fungus *R. nigricans* on the jak-fruit showed the typical symptoms of the soft rot caused by *R. artocarpi*, but the sporangiophores became more elongated and formed a gray mass as the infection advanced. This gray mass in time developed a few black sporangia. The fruits infected by *R. nigricans* were very different in appearance from those infected by *R. artocarpi*. The growth of *R. nigricans* on the fruit was very irregular, the sporangiophores were comparatively longer, and the black sporangia less numerous than in the case of *R. artocarpi*. Measurements of full grown sporangia of these two species gave an average diameter of 137.2 microns for *R. nigricans* and 155.2 microns for *R. artocarpi*. The spores of *R. nigricans* were smaller and more spherical in shape than those of *R. artocarpi*; they had average diameters of, 7.82 microns and 11.35 microns respectively.

From the measurements given above and the morphological differences, especially septation and general appearance of sporangiophores, it is concluded that *R. nigricans* and *R. artocarpi* are distinct species. Of the two, contrary to expectations, the *R. nigricans* was slightly more virulent than the *R. artocarpi*.

R. nigricans has long been recognized as a wound parasite and the cause of rots in stored fruits and vegetables. In the case of jak-fruit, experiments show that *R. nigricans* can behave as a true parasite and attack the young uninjured fruits while still attached to the tree.

SUMMARY OF CONCLUSIONS

1. Under natural field conditions of infection, the disease became fully developed four to five days after first signs of the disease were evident.

2. *R. artocarpi* grows well on potato agar. In liquid media it produced acid of sufficient concentration to change the litmus indicator present from blue to red.

3. *R. nigricans*, is slightly more virulent in producing jak-fruit rot than is *R. artocarpi*.

4. *R. nigricans* produced the typical symptoms of soft rot caused by *R. artocarpi*. In this case, the species *R. nigricans* behaved as a true parasite.

5. The sporangiophores and mycelium of *R. artocarpi* were more frequently septate, and the sporangia and spores were larger than those of *R. nigricans*. The sporangiophores of *R. nigricans* were longer and formed fewer black sporangia.

6. *R. artocarpi* and *R. nigricans* are two distinct species.

CONTROL

1. Reinking (1) suggests that all diseased inflorescences should be picked and destroyed. Bordeaux mixture may be sprayed in severe cases.

2. Bagging the fruits with cloth or paper at the time of flowering may help to keep the fruits from infection. This is only practicable on a small scale.

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THE COST OF RAISING SWINE UNDER EXISTING CONDITIONS IN THE COLLEGE OF AGRICULTURE[1]

By Daniel B. Peña

WITH ONE CHART

INTRODUCTION

The increase in the number of hogs in the Philippines shows a healthy growth of the swine industry. There were 2,521,143 in 1915 and 3,129,676 in 1919.[2] This increase may be attributed to the general improvement in the prosperity of the country. In spite of this increase in number, however, the Philippines imported swine products to the value of ₱14,371,906 for the seven years 1913-1920.[3] So large an importation shows that there is room for greater improvement in the hog raising industry in this country.

OBJECTS

The primary object of this experiment was to find out whether or not hog raising under existing conditions in the College of Agriculture is profitable; the secondary object was to find what relation the proportion of Berkshire blood has to the rapidity of growth of pigs.

The work was begun in August 11, 1920, and ended December 1, 1921, in the College of Agriculture.

MATERIALS AND METHODS

The animals used in this experiment belonged to the Animal Husbandry Department. From the herd of the department the sows that had farrowed were selected. These animals were confined, one sow and its litter in a lot, in the house, till the animals became perfectly tame. Each lot was provided with clean bedding of rice straw or excelsior, a trough and a feed box. Every morning the quarters were cleaned (and at other times if it was necessary) before the swine were fed. At the end of each week the sows, the pigs, and the feeds were weighed.

Usually the pigs became fairly independent of the sows at about nine weeks of age; and at this time they were weaned. The sows were gradually separated from the litters at night and when the pigs became used to the separation it was made complete, by putting the sows with the general herd and the pigs in a lot of their own.

This procedure was repeated several times as the sows did not farrow at the same time. The litters used as specimens were farrowed on August 5, August 11, October 9, October 17, and December 23, 1920, and April 12, June 5, June 17, August 20 (two litters), and September 27, 1921.

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[1] Thesis presented for graduation with the degree of Bachelor of Agriculture from the College of Agriculture; No. 177. Experiment Station contribution No. 227. Prepared in the Department of Animal Husbandry under the direction of Prof. B. M. Gonzalez and Prof. E. D. Hester.

[2] Statistical Bulletin No. 3. 89-90. Philippine Bureau of Commerce and Industry, Manila, 1920.

[3] Economic Information Circular No. 1. College of Agriculture, 1922.

As it was the object of the experiment to study conditions as they were no effort was made to keep all the pigs until the end of the experiment. From time to time the pigs were sold as buyers came. The scrub, or undesirable boars were castrated; the good ones were allowed to grow large uncastrated. This selection was made particularly with the seven-eighths Berkshire-litters. When the litters were weaned and the pigs were large enough, they were numbered on the ears and placed in a lot, gilts and barrows together.

Not including the pigs that died, 73 pigs, 9 sows, and 11 litters were used in this study. Two litters from a three-fourths Berkshire-native sow; three litters from two one-half grade Berkshire-native sow; three litters from three native sows; and three other litters from sows of mixed breeding.

From the beginning of the experiment the feed used for the swine was a mixture of rice bran, copra meal, and flint corn. From March 16, 1921, to October 26, 1921, corn became so scarce and expensive that the swine were given a mixture of rice bran and copra meal of the proportion, 1 rice bran to 2 copra meal. Later, on October 27, 1921, the Animal Husbandry Department secured enough corn for the hogs and, again, the former mixture was given. The pigs were weighed generally four hours after feeding, occasionally they were weighed after six hours.

Usually, when the pigs were normal, they began to try to eat after the fourth week, and at the sixth week they were good eaters. A large sized bamboo internode, having the nodes uninjured at both ends, put on a good frame to make it stable, made a serviceable small pig trough. When the sow was so greedy that she interfered with the pigs when eating, a creep was made for the pigs' trough so only the small ones could get to it. At the age of eight weeks the mother was separated every other night from the pigs. The separation was gradually prolonged until the complete separation which occurred about the ninth or tenth week.

GROWTH OF THE ANIMALS

THE EXPERIMENT

Object.—The object of this experiment was to find what relation the intensity of Berkshire blood has to the rapidity of growth of the pigs, when a Berkshire boar is used as a sire to native sows.

Plan.—On August 5, 1920 sow No. 97, one-half grade Berkshire-native, farrowed. From this time up to August 27, 1921, every sow that farrowed was confined in a lot, weighed weekly, including each of the pigs in the litter. Close attention was given in weighing them. For the purpose of comparison, pigs which were 50 per cent Berkshire blood and 50 per cent native, or one-half grade were called Lot I. There were 23 pigs in this lot. Pigs having 75 per cent Berkshire blood and 25 per cent native blood, or three-fourths grade, were called Lot II. There were 21 pigs in this lot. Pigs having 87.5 per cent Berkshire blood and 12.5 per cent native blood, or seven-eighths, were designated as Lot III. There were 13 pigs in this lot. Lot IV consisted of pigs from two native sows bred accidentally by three-fourths grade young boars and from a three-fourths grade gilt bred by a litter mate. There were 16 pigs in this lot. Lot IV was included although it was a mixed lot as the pigs were a part of the herd on which commercial observations were made. Their proportion of Berkshire blood would average about one-half.

Feeding.—For every sow, a feed container, either a box or an empty barrel, was provided. This container was numbered according to the number of the sow. The feed for the particular sow was placed there in quantities calculated to last, at least seven days. Each morning and afternoon the feed for the sow was taken from the container. At the end of the week the remaining feed was weighed and the difference between this and the amount put in the container was recorded as consumed.

To determine how much a sow would eat, a known amount of feed was put in a pail and given to her in the form in which she was accustomed to eat it. She was allowed to eat until satisfied. This was a safe plan for obtaining a quantity basis, otherwise she might have had more food than she could clean up, or she might not have had enough. In the experiment, wet feed was the form most liked by the swine. Feed soaked for several hours before feeding was so bulky that the pigs were not able to eat enough to provide sufficient nourishment. The morning feeding was usually from seven to eight o'clock; clean water was placed in the troughs. When it was necessary to confine the animals the whole day, at noon and in the afternoon, green leaves of ipil-ipil (*Leucaena glauca* Linn.), or camote leaves (*Ipomoea batatas* Linn.), were given. When the swine were free to forage by themselves during the night, then soiling was done only at noon. The pens were cleaned before feeding.

The pigs were given charcoal made from corn cobs mixed with common salt every Wednesday and Saturday.

All the work was performed by the writer. Great care was exercised that the swine received enough feed to perfectly satisfy them. This problem was solved empirically through practice and close observation.

Weighing.—Saturday noon was chosen as the weighing time. When the pigs were from one to three weeks old an empty petroleum box was placed on the balance and the pigs put therein. The box was weighed and accurately recorded and its tare subtracted from the gross to find the net weight. When the pigs became large enough and handling was awkward, a crate on the balances into which each pig was easily driven proved satisfactory.

DISCUSSION OF GROWTH DATA

A summary of the growth data is presented in Table I.

Lot I.—The curve in Chart I representing Lot I, composed of half-grade animals, shows the growth of three litters containing in all, 23 pigs. The sire was pure breed Berkshire boar No. 43 and the dams are indicated in Table II. There were 20 pigs in the lot at the end of the growth observations.

In general the pigs grew normally from birth up to the eighth week, when the sow was gradually separated from the litter. From the eighth to the ninth week the average gain was only two tenths of a kilogram. From the ninth week to the tenth, the pigs having become accustomed to separation from the sow, registered a gain of about six tenths of a kilogram; at this time the separation was made complete and the pigs grew steadily up to the twenty-fourth week, with an average gain of about one kilogram a week.

Lot II.—The data and curve representing Lot II shows the growth of three litters containing 21 pigs possessing 75 per cent Berkshire blood. These animals were from three litters, 13 of which were from two litters born eight months ahead

of the third one. The sire of these animals was also pure breed Berkshire boar No. 43; the dams were one-half grade Berkshire-native. The history of each of these litters is indicated in Table II. The growth of the pigs was normal and rapid. As might be expected there was apparently no set back to the growth of these pigs when they were weaned. One of the first litters consisting of nine pigs was weaned rather early because the dam died of kidney worms. The pigs were fed cow's milk for a time. This lot had 17 pigs at the end of the experiment.

Lot III.—For Lot III, the graph represents two litters of the same dam, farrowed eight months apart, comprising 13 pigs. The dam was three-fourths grade, and the sire of both litters was Berkshire boar No. 43. The pigs carried, therefore, seven-eighths Berkshire blood. They were beautiful animals, refined, docile, and grew fast. Their rapid growth was checked partly when they were weaned. This lot ended with 9 pigs.

Lot IV.—Lot IV is represented by an irregular curve in Chart I. This is to be expected, as the lot was not uniform. The entire lot represents three litters and a total of 16 pigs. Their record ends at 15th week, as the observations ended then. At the time there were 13 pigs in the lot.

In the care, management, and feeding, great care was exercised that all the animals should receive the same treatment. Lot III showed distinct superiority over the other lots throughout the period of observation. Lot II came second, Lot I third, and Lot IV, the last. Not only in the rapidity of growth did Lot III surpass the other lots, but in the quality of the animals as well. The type, conformation, and general make-up of these animals was more Berkshire than native. Lot II was not far behind and there were a few individuals in this lot which could well compete with the best animals in Lot III. In Lot IV, many of the pigs that were from the three-quarters Berkshire gilt, were similar to those with seven-eighths or three-quarters Berkshire blood. The pigs in Lot I were coarser than the pigs in Lots II, and III. But all were certainly better than native pigs in the thickness of the sides, quarters, and backs. Up to 24 weeks the grade pigs gained in weight in direct ratio to the proportion of the Berkshire blood. That is, the more Berkshire blood a grade pig had the more rapid its gain. There is every reason to believe that this assumption might have been generally true, up to the time of complete maturity, if all the boars had been castrated. The boars did not generally gain in weight as rapidly as the barrows or gilts. Their restlessness consumes the energy which would normally be utilized in laying on flesh and fat. Although there was a record of growth up to one year in a number of the animals it was deemed best to present the data up to the 24th week only, as after that date many of the pigs either died or were sold. Some kind of selection became operative, therefore, and the figures besides being based on a few animals could not very well be considered as normal.

History of the pigs.—The gestation period of the sows used in this experiment ranged from 111 to 118 days, with an average of 115 days. This period includes from the day of breeding to the day of farrowing. An average of about eight and a half pigs to a litter is the record of the sows used, but due to the high mortality of the young pigs, only about seven pigs (6.6) to a litter were raised, giving 21.5 per cent mortality. A number of the larger pigs died of hog cholera, kidney worms, and lung worms (*Filaria*) and blood poisoning (*septicemia*). The causes of the death of some pigs at birth when the other members of the litter

were perfectly healthy, was unknown. Some pigs were born so small and weak that they did not live longer than a day or two. The cause of this inferiority is also unknown.

All the pigs in this experiment were sired by Berkshire boar, No. 43, imported from the United States, except those from sows Nos. 135, 307 and 309A. Sow 97 was a one-half grade gilt and was the dam of two litters used in the experiment. Sow 88 was 50 per cent Berkshire and 50 per cent native (Jala-Jala). She died of kidney worms when her litter was about seven weeks old. Sow 114 was a three-fourths Berkshire grade. She was the dam of two litters used in this experiment also. Sow 306 was a native (Jala-Jala). She died of hog cholera when she was about to farrow her second litter for the year. The first litter of this sow was used in Lot II. Sows 308 and 309 were native gilts from Los Baños. Sows 307 and 309A were native gilts of poor conformation, thin, small, narrow, and razor-backed. They weighed at the time they were covered about 45 kilograms. Sow 135 was a three-fourths Berkshire. The last three were bred accidentally by herd mates, young three-fourths Berkshire pigs. The dates of their mating, farrowing, and the number of pigs in the litter are all shown in Table II.

MARKETING THE SWINE AND SWINE PRODUCTS

THE EXPERIMENT

Object.—The object of this experiment was to find out whether or not hog raising under existing conditions in the College of Agriculture is profitable.

Materials and plan.—The materials used in this experiment were the same materials used in Experiment One. The work was run concurrently with the growth experiment, but the results cannot be clearly presented except by separating the two different phases involved in the work. Hence, the animal husbandry phase and the economic phase are here treated separately.

It was the primary plan of this experiment to record any phase of work which financially affected the herd under observation; to convert the time spent on the herd into its money equivalent; to add to this the cost of the feed consumed, the cost of the disinfectants used, and the depreciation of the equipment used, and the rent of the land and sows, and depreciation on the sows. The total sum of the items given above was subtracted from the sum of the revenue derived from the sale of the product. The economic experiment was originally supposed to run for only one year, but it was finally decided to prolong it to 16 months in order to make it equal in time to the growth experiment. The desired end of the economic experiment was to show the net gain or loss.

Economy in feeding.—As much economy was practiced in feeding as was consistent with proper nourishment of the swine.

Disposal of the pork.—According to the plan of the experiment the Department of Animal Husbandry of the College, acted as market commissioner paying the writer who was held as primary producer an over-all price which was calculated by the department on the basis of probable salable dressed-out weight; butchering and marketing at 5 per cent of gross receipts; and the expected retail price. Mr. Francisco P. Lago was in charge of the business for the Animal Husbandry Department.

Twenty-three pigs for breeding (with a total live weight of 629.6 kilograms) were sold outright for ₱610.45. This amount was paid directly to the supposed producer. There were sold 48 hogs for meat, total live-weight 1984.7 kilograms.

Two pigs died during the experiment. This accounts for the total of 73 pigs used. Two other pigs were fed with these pigs and their increase during the period was added to the total gain. Their total initial weight was 5.4 kilograms and their weight at the end of the period of observation was 72 kilograms or a net gain of 66.6 kilograms. The total weight of the pigs sold for meat was therefore 2051.3 kilograms.

In nursing the litters the sows lost an aggregate weight of 203.5 kilograms

TABLE III.—*Showing weight of the sows.*

Sows.	No. 88	No. 97	No. 114	No. 306	No. 309	No. 97	No. 114	No. 308	No. 307	No. 309A	No. 135	Total weight.
	kg.	*kg.*	*kg.*	*kg.*	*kg.*	*kg.*	*kg.*	*kg.*	*kg.*	*kg.*	*kg.*	*kg.*
Initial weight...	140	80	140	121	52	78	158	97	60	50.5	103	1079.5
Final weight....	died	67	120	91	50	65	118	77	32	30	86	736
Difference.....	140	13	20	30	2	13	40	20	28	20.5	17	343.5

and one sow, weighing 140 kilograms died (see Table III). A total of 343.5 kilograms were, therefore, accounted for as depreciation on sows. As the sows were turned back to the College herd after weaning their pigs, this system of computation was devised, by which the writer as operator assumed the risk of any loss in weight or total loss of the sows through death, by paying the College the actual value as pork, paid a rent of ₱5 a litter of each sow used, and paid a price of ₱2.50 a head for each pig. The pigs were not all actually butchered. At the close of the experiment they were weighed. The breeding pigs mentioned above were practically all sold.

Observations at the College have shown that if the dressed weight of an animal is multiplied by the retail price of pork, one cannot expect to have that return in practice. For example, a pig weighing 100 kilograms dresses 75 per cent, or 75 kilograms. If the retail price of pork is ₱1 a kilogram, one would figure on getting ₱75 from the pig. There are, however, parts of the carcass which cannot be sold at the stated market price, as the head and shanks. There are also losses due to trimmings, shrinkage or drying, etc. These are not fully compensated by the fact that one is able to sell most of the viscera, which are not included in the dressed weight. There is also occasionally some meat remaining unsold towards the end of the day which has to be disposed of at bragain prices. Unpublished data of the Animal Husbandry Department shows that the average return in actual cash is 84 per cent of the dressed weight times the retail price of dressed pork. This is effectively 63 per cent of the live weight. [Live-weight x .75 (dressed-weight) x 84. (salable-weight) = Live-weight x .63] So that in the above example the net return would be .63 x 100 x ₱1 or ₱63.

The retail price of pork at the time, however, was ₱1.20. The 2051.3 kilograms meat sold, netted therefore, (63 per cent x 2051.3 x ₱1.20) ₱1550.78.

RESULTS

From a commercial angle the income and expenditure may be summarized as follows:

(*a*) *Income*

Sales:	
23 pigs for breeding (629.6 kilograms)	₱ 610.45
50 pigs for meat (2051.3 kilograms)	1,550.78
Gross income	₱2,161.23

(*b*) *Expenses*

Rent of 1.1 hectares (value ₱165.00) for 1⅓ years at 12% per annum	26.40
Capital Goods:	
Interest charge on 1 building (value ₱700) for 1⅓ years at 12% per annum	112.00
Depreciation 10% per annum	93.33
Interest on 640 meters fencing (value ₱440.00) for 1⅓ years at 12% per annum	70.40
Depreciation at 10% per annum	58.67
Interest on 1 balance (value ₱60.00) for 1⅓ years 12% per annum	9.60
Depreciation at 3% per annum	2.40
Rent of 9 sows with 11 litters at ₱5.00 per litter	55.00
Depreciation on sows. (343.5 kilograms)	259.69
Labor:	
General labor cost	240.00
Butchering charge	77.54
Supplies:	
1 tin crude oil	1.50
2 bottles creolin	2.76
11 feeding troughs	35.00
Feeds:	
6857.4 kilograms copra meal at average price ₱ 0.04	
3836.8 kilograms rice bran at average price 0.05	545.98
1175.0 kilograms maize at average price 0.07	
Purchases:	
73 pigs at ₱2.50 each	182.50
Expenses	₱1,772.77

(*c*) *Net income:*

Gross income	₱2,161.23
Expenses	1,772.77
Net income	₱ 388.46

(*d*) Details of gross income have been arranged in the following lists:

Animals sold for breeding.

	Litter No.	*Weight kg.*	*Income*
Gilt No. 131	88	15.0	₱20.00
Gilt No. 136	88	15.0	20.00
Gilt No. 139	88	21.7	27.00
Gilt No. 130	88	17.7	24.00
Boar No. 140	88	22.7	23.00
Boar No. 142	88	22.0	22.00
Boar No. 134	97	20.0	20.00
Boar No. 144	114	19.6	23.00
Boar No. 149	114	10.8	25.00
Boar No. 145	114	18.7	29.00
Boar No. 150	306	12.9	12.00
Boar No. 151	306	9.9	10.00
Boar No. 132	97	50.0	45.00
Boar No. 133	97	39.0	30.00
Boar No. 147	114	107.0	81.00
Gilt No. 148	114	101.0	75.75
Gilt No. 164	97	26.0	28.00
Gilt No. 165	97	26.0	28.00
Boar No. 175	114	25.0	30.00
Boar No. 187	135	8.0	6.75
Boar No. 188	307	16.6	12.45
Boar No. 189	307	11.0	8.25
Gilt No. 202	135	14.0	10.00
Total		629.6	₱610.45

Animals sold for meat.

	Litter No.	Weight kg.	Income
Gilt No. 141	88	54.0	
Barrow No. 137	88	103.0	
Gilt No. 138	88	120.0	
Gilt No. 135	97	115.0	
Barrow No. 143	114	55.0	
Gilt No. 146	114	93.0	
Barrow No. 152	306	110.0	
Barrow No. 153	306	94.0	
Gilt No. 154	306	67.0	
Gilt No. 155	306	80.2	
Barrow No. 157	309	39.0	
Barrow No. 158	309	78.0	
Gilt No. 160	309	70.0	
Gilt No. 161	309	77.0	
Barrow No. 162	309	83.0	
Barrow No. 163	97	41.0	
Barrow No. 166	97	41.0	
Gilt No. 167	97	41.0	
Gilt No. 168	97	43.5	
Gilt No. 169	97	45.5	
Gilt No. 170	97	43.5	
Gilt No. 701	114	38.0	
Boar No. 172	114	31.0	
Boar No. 173	114	32.0	
Boar No. 174	114	31.0	
Boar No. 176	114	33.0	
Barrow No. 177	308	21.0	
Barrow No. 178	308	26.0	
Barrow No. 179	308	20.5	
Barrow No. 180	308	17.5	
Barrow No. 181	308	25.5	
Barrow No. 182	308	17.5	
Gilt No. 183	308	20.5	
Barrow No. 184	308	20.0	
Gilt No. 185	308	24.0	
Gilt No. 186	308	19.0	
Gilt No. 190	307	10.0	
Gilt No. 191	307	6.5	
Barrow No. 192	309A	12.0	
Gilt No. 193	309A	17.0	
Gilt No. 194	309A	12.0	
Barrow No. 195	309A	11.0	
Barrow No. 196	309A	10.0	
Gilt No. 197	135	8.0	
Gilt No. 198	135	10.0	
Gilt No. 199	135	10.0	
Gilt No. 200	135	8.0	
Gilt No. 201	135	11.0	
Gilt No. 3	net gain	29.6	
Gilt No. 4	net gain	37.0	
Total	2051.3		₱ 1,550.78

Labor Cost.—The general labor on the project was approximately the half time of a laborer earning ₱30 a month, or ₱15. The experiment lasted 16 months. His wages were therefore ₱240. The butchering and marketing charge was 5 per cent of gross receipts, or ₱77.54.

Feeding Costs.—The prevailing price of corn, rice bran, and copra meal from August 1920 to January 1921 was ₱0.10, ₱0.10, and ₱0.075 per kilogram, respectively. Due to the crisis in 1921 the prices dropped down to ₱0.04, ₱0.04, and ₱0.03. The bulk of the feed was consumed in 1921, since the pigs were rather small at the beginning of the experiment. Retail pork dropped down from ₱1.50 to ₱1.20 at about the same period.

DISCUSSION OF RESULTS

Relation of net income to investment.—Considering the investment to constitute the average between the opening and closing inventories[4] which would be ₱1276.65, the net income, ₱388.46 was 30.5 per cent of the average investment for a period of 1⅓ years or 22.9 per cent per annum.

Conditions affecting net income.—The conditions affecting the net income were four, so far as the writer could account; (1) The equipment was used not only in this experiment but also by the College herd as a whole, hence the depreciation to be charged this experiment could be lower; (2) the swine did not reach maturity so as to realize full benefits; (3) under commercial scale, the writer thinks that the number of pigs raised could be made two times the number used in the experiment without increasing appreciably the capital invested in equipment. On the other hand (4) there was a sudden drop in feed prices to about 40 per cent from the beginning of the experiment until it ended. The price of pork lagged, dropping from ₱1.50 to ₱1.20 a kilogram at the end of the experiment, a reduction to only 80 per cent of the original price. All in all, the conditions for making good profits were probably more favorable in the experiment than at normal times.

Cost of production of one kilogram of pork.—The total live weight of production, including both meat and breeding animals was 2680.9 kilograms. The expenses of production including butchering and marketing charges, were ₱1772.77. The cost reduced was, therefore, ₱0.661 a kilogram of live weight.

The total dressed weight at 75 per cent was 2010.7 kilograms which establishes a cost of ₱0.882 a kilogram of dressed weight.

The total salable weight, 84 per cent of dressed weight was 1689 kilograms which establishes a cost of ₱1.05 a kilogram of salable weight.

SUMMARY AND CONCLUSIONS

GROWTH EXPERIMENT

Litters of pigs, reared under the College of Agriculture, possessing the least intense Berkshire blood gained the slowest; and the litters of pigs having the most intense Berkshire blood gained the most rapidly from birth up to 24 weeks or about six months. The rapidity of growth of Berkshire grade pigs is in direct ratio to the intensity of Berkshire blood. It was observed that boar pigs usually gained in weight less rapidly than gilts or barrows.

ECONOMIC EXPERIMENT

a. Even under existing conditions in the College of Agriculture, where hogs are raised for experimentation, not for gain, the project was profitable when the retail price of pork was ₱1.20 a kilogram. It was found by this experiment that with a capital of ₱1276.65 the College realized a net gain of 22.9 per cent per annum on the investment. Under the account of net income, ₱388.46 was the yield of one and one-tenth hectares of land for 1⅓ years which reduces to ₱265.13 a hectare per annum exclusive of the rent of the land.

b. It was shown above that it cost ₱0.661 to produce a live weight kilogram of pork; hence a year old hog weighing 80 kilograms live weight raised by the College of Agriculture at that time required ₱52.88, and the hog when converted into pork and sold, realized 50.4 kilograms of salable meat which at ₱1.20 a kilogram gave ₱60.48.

c. It was also shown that it required about 5.08 kilograms of feed to produce 1 kilogram gain.

d. That after deducting all costs of operation; rent, feed, labor, interest and depreciation charges, the managerial income of the operator on an investment of ₱1,276.65 for 16 months was ₱388.46 or ₱291.65 per annum.

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[4] Inventories on file, Department of Animal Husbandry.

e. Assuming the project to be in charge of a technically trained man, as was the case herein, for instance a college graduate with a family, he should require a managerial income of four times that realized (₱1166.60). To attain this he should need about ₱5000 capitalization and a market for approximately 5100 kilograms of pork per annum at a retail price of not less than ₱1.20 per kilogram. He would have to do his own butchering and marketing as it is scarcely likely that any middleman would handle that end on a five per cent margin. In the latter case his income should be increased correspondingly.

TABLE I.—*Showing weight at birth and average weekly weights thereafter of the pigs used in the experiment.*

	Lot I.			Lot II.			Lot III.			Lot IV.		
	No. of pigs.	Total wt.	Av. wt.	No. of pigs.	Total wt.	Av. wt.	No. of pigs.	Total wt.	Av. wt.	No. of pigs.	Total wt.	Av. wt.
		kg.	*kg.*		*kg.*	*kg.*		*kg.*	*kg.*		*kg.*	*kg.*
At birth...	23	17.70	.769	21	18.555	.883	13	13.28	1.02	16	15.0	.93
1 wk.....	23	31.42	1.366	21	39.2	1.86	13	25.5	1.96	16	25.7	1.60
2 wk.....	23	50.00	2.17	21	55.3	2.68	13	37.4	2.87	16	43.8	2.73
3 wk.....	23	66.1	2.87	21	67.95	3.23	13	50.8	3.90	16	61.3	3.83
4 wk.....	23	81.5	3.54	21	79.9	3.80	13	61.4	4.72	16	74.5	4.65
5 wk.....	22	93.4	4.24	21	97.1	4.62	13	77.3	5.94	16	83.5	5.21
6 wk.....	22	112.9	5.13	21	116.4	5.54	13	90.3	6.94	16	90.5	5.65
7 wk.....	22	121.9	5.54	21	140.3	6.68	13	110.2	8.47	16	97.8	6.11
8 wk.....	22	139.3	6.33	21	150.4	7.16	13	126.1	9.70	16	102.0	6.37
9 wk.....	22	150.6	6.84	21	184.4	8.78	13	130.0	10.00	16	109.5	6.84
10 wk.....	22	163.0	7.40	21	196.9	9.38	13	152.4	11.72	16	117.6	7.35
11 wk.....	22	177.5	8.06	21	217.2	10.34	12	148.5	12.70	16	123.3	7.70
12 wk.....	22	198.4	9.01	21	231.0	11.00	12	156.6	13.05	16	139.1	8.69
13 wk.....	22	216.9	9.76	21	246.6	11.74	12	164.8	13.73	15	144.3	9.62
14 wk.....	22	233.0	10.59	21	276.0	13.13	12	178.4	14.86	13	126.5	9.73
15 wk.....	22	255.1	11.59	21	291.7	13.90	12	192.5	16.04	End of Experiment		
16 wk.....	22	269.6	12.25	21	312.6	14.40	11	186.2	16.92			
17 wk.....	21	277.5	13.21	21	331.5	15.78	11	202.9	18.44			
18 wk.....	21	309.6	14.74				10	198.1	19.81			
19 wk.....	20	319.2	15.96		*a*		9	192.3	21.36			
20 wk.....	20	336.5	16.82	20	386.2	19.31	9	207.3	23.03			
21 wk.....	20	351.4	17.57	20	424.3	21.21	9	222.1	24.67			
22 wk.....	20	367.9	18.36	20	444.5	22.23	9	231.0	25.66			
23 wk.....	20	387.6	19.38	19	444.5	23.40	9	242.2	26.91			
24 wk.....	20	426.8	21.34	17	446.2	26.25	9	251.2	27.91			

a One litter not weighed for 2 weeks.

TABLE II.—*Presenting history of the litters.*

Sows.		Date mated.	Date forrowed.	Period of gestation.	No. of pigs farrowed.		No. of pigs dead or very weak at birth.		Pigs used in experiment.	
No.	Kinds.				Male.	Female.	Male.	Female.	Male.	Female.
97	1/2	April 14	Aug. 5	113	3	2	—	1	3	1
88	1/2	April 17	Aug. 11	116	6	6	1	2	5	4
114	3/4	June 15	Oct. 9	116	4	3	—	—	4	3
306	N	June 25	Oct. 17	114	4	6	—	3	4	3
309	N	Sept. 2	Dec. 23	112	4	2	—	—	4	2
97	1/2	Dec. 20	April 12	113	3	6	1	—	2	6
114	3/4	Feb. 9	June 5	116	5	5	1	3	4	2
308	N	Feb. 23	June 17	114	6	4	—	—	6	4
307*a*	N	April 26	Aug. 20	116	3	4	1	2	3	1
309*a*	N	April 26	Aug. 20	116	3	4	1	1	2	3
135*a*	3/4	April 30	Aug. 26	118	2	8	1	2	1	6
Totals—(Average).....				115	43	50	6	14	38	35

a Accidental mating, young boars broke through the fence to sows.

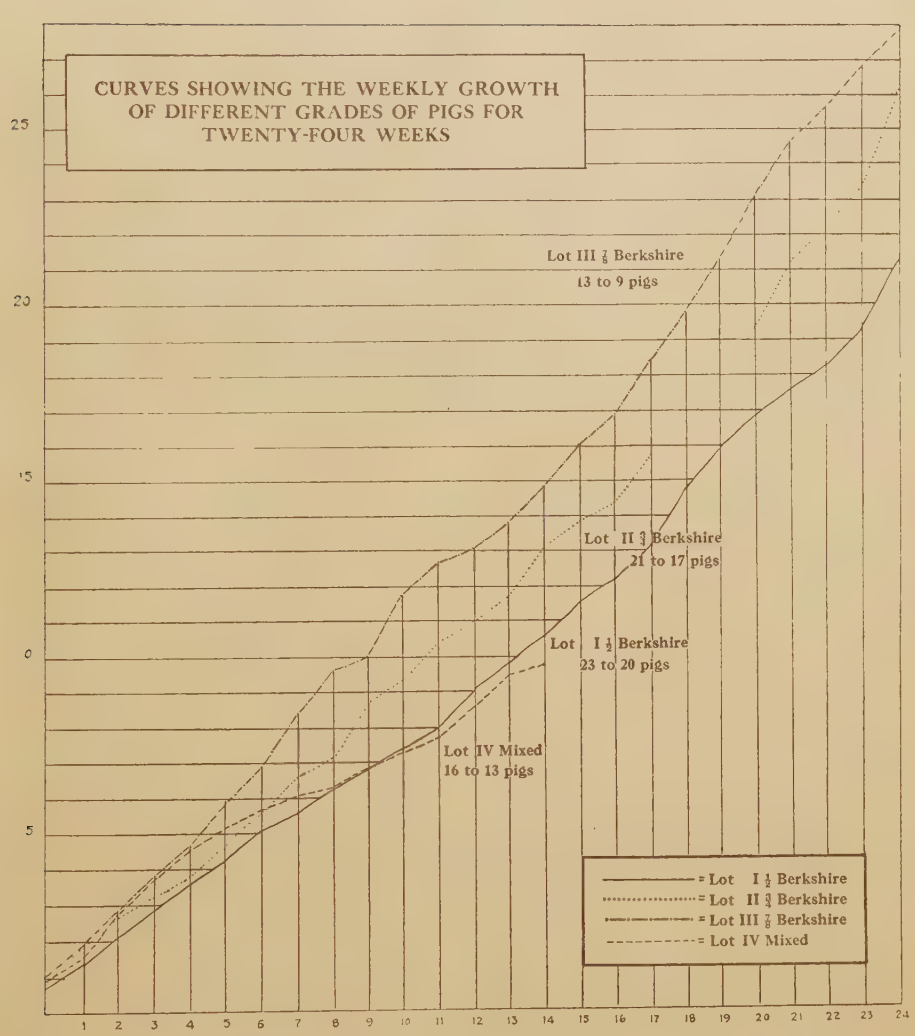
CURVES SHOWING THE WEEKLY GROWTH OF DIFFERENT GRADES OF PIGS FOR TWENTY-FOUR WEEKS
25
20
15
0
5
Lot III ⅞ Berkshire
13 to 9 pigs
Lot II ¾ Berkshire
21 to 17 pigs
Lot I ½ Berkshire
23 to 20 pigs
Lot IV Mixed
16 to 13 pigs
= Lot I ½ Berkshire
= Lot II ¾ Berkshire
= Lot III ⅞ Berkshire
= Lot IV Mixed
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Chart 1.—Growth curves.

RELATION OF THE COLLEGE OF AGRICULTURE TO LOWER SCHOOLS[1]

By Evett D. Hester
Registrar, College of Agriculture

WITH ONE TEXT FIGURE

The College of Agriculture of the University of the Philippines has from its date of establishment been burdened with the problem of articulation of its curricula with a constantly expanding number and increasing complexity of lower school curricula. The problem has been made more difficult by the necessity of keeping the upper end of the curricula of the College (the upper end being indicated by the degree of Bachelor of Science in Agriculture) in equivalency with like curricula in colleges of agriculture in the United States. This necessity is not subject herein to critical analysis. It is a University, even a national, educational standard. The College itself has no voice either in decreeing the general standard of American agricultural colleges, or in altering radically the University policy of equivalency therewith. This policy we may dismiss as a constancy.

That the College of Agriculture has successfully maintained this "upper end" articulation, is proved by the fact that it has been ranked "A" by American universities and by the less arbitrary and more essential test that many Bachelors of Science from the College of Agriculture have transferred to American universities for graduate work and none have experienced difficulty in earning their Master's degrees in one year and their Doctorates in three years.

This articulation has been maintained in the face of inadequate funds; a rapidly shifting foreign faculty; the necessity, through a system of government foreign scholarships, of rapidly substituting a permanent Filipino faculty of high attainments; a negligible background of tropical agricultural knowledge involving the precedence of heavy research for each step in the teaching of each technical course; the early necessity of creating a dignity of labor against an adverse social psychology; and frequent lack of sympathy from higher authorities. That it has been accomplished is a near-miracle and a monument to two men such as other founders and pioneers may envy.

The present paper is, however, particularly concerned with the "lower end" articulation—the relation of the College of Agriculture to lower schools. Colleges of liberal arts and of the ancient professions and, in the United States, colleges of agriculture as well, have merely set up as entrance requirement the completion of the standard high school course as evidenced either by accreditation or examination. Adjustments for a few "conditioned" students who have failed in one subject in the final year of their high school curriculum has represented the maximum burden of lower-end articulation which such colleges have borne.

With the College of Agriculture the case has been far different and less facile. From the beginning of the institution several conditions were obvious: (a) The

[1] General contribution from the College of Agriculture No. 113.

high school as constituted on a belletristic basis was by no means the best preparation for the Bachelor of Science in Agriculture curriculum; (b) The youth of the Islands were enamoured with the classics and "learned professions" naturally, as they had, for three hundred years been more or less effectively ostracised from these ambitions; (c) The high schools tended to wean their students away from the soil; (d) Largely the sons of the less prosperous element of the country sought agriculture as a vocation and were unable to capitalize the conventional eight year (high school and college) regimen above their elementary schooling; (e) The first primary English-speaking schools opened to an enrollment averaging over ten years of age which placed the early intermediate (elementary, or grammar) school graduates at seventeen or eighteen years of age, when in consonance with the relative early maturity and high mortality of the race it was inefficient to postpone bread-winning for eight more years. (f) A student in any one of the four years of the high school would suddenly experience what psychologists might term a "vocational shock" and immediately wish to undertake technical agriculture, luckily there were no vocational analysts to confuse his selection. (g) Considering all causes, it was patent that there were not enough high school graduates who would appreciate the advantages of technical agriculture to give the College the numerical weight necessary for the justification of its existence.

Finally, the question resolved itself into the possibility of taking intermediate school graduates, putting them through a six year curriculum and turning them out as competent, technically, as their more favored brothers who would have spent eight years, four in high school and four in college, to attain the same practical end. If this could be done most of the problems outlined in the paragraph above would be solved; if not, merely another and useful educational experiment would have been written. "The proof of the pudding being in the eating thereof," the first Dean accepted the challenge and the College opened to two groups of student:

> *Group I.*—High school graduates who would immediately undertake a four-year technical agricultural curriculum.
>
> *Group II.*—Intermediate school graduates who would undertake two years of preparatory work in lieu of high school and then join the first group for a practically identical four-year technical agricultural curriculum.

For honesty, policy, and correlation with foreign standards, Group I, the high school graduates, were to be given the degree Bachelor of Science in Agriculture and Group II, the intermediate school graduates, were to be given the modified degree, Bachelor of Agriculture. From the fact that both groups were to complete a full four-year technical course, it would be unjust to give the second group merely a diploma as they were to accomplish actual degree work. It was, however, expedient to modify terminology sufficient to avoid confusion and to serve as a signal that Group II were different from Group I in educational experience.

Thus at the very beginning a broad policy was established; first, to facilitate lower-end articulation it was made easy to get into the College; and secondly, to retain upper-end articulation and general standards it was made difficult to get through the College. Later, scholarship rules of a strict type were established to make it difficult to remain in the College and to furnish the necessary check to the broad entrance policy.

The experiment worked, and as we are all pragmatists at heart, that is sufficient apology. The policies have been continued to this hour. The lateral flexibility of entrance has been increased so that the records of the Registrar's Office show the receipt of students from every type of intermediate school—general, trade, industrial, and farm—; from every type of high school—general, normal, commercial, trade, and agricultural—and transfers from every type of college and special school with the exception of nautical, military, fine arts, and music. And from each type of high school have come students from every year thereof. From this complexity of source have arisen graduates of precisely equal technical knowledge who have taken co-ordinate positions in after life and have maintained them with equal success. The accomplishment stands as one of the most notable illustrations of economy in education in the present Philippine system.

The only substantial difference between Group I, Bachelor of Science in Agriculture, and Group II, Bachelor of Agriculture, is that the latter have studied neither Myer's *History of Europe*, nor the *Literature of England from Chaucer to Kipling*. There are those, who, because of this deficiency in belles lettres would eliminate the "six year course" on the general basis that it "looks bad". Significantly, the detractors are those who have not been in personal contact either with the working of the broad entrance system at the College or with the two classes of graduates. In the light of the necessity for early improvement of the agricultural resources of the Philippine Islands, why strain at the Chaucerian gnat? It would be interesting, profitable, and perhaps final to submit several successive classes of both groups of graduates to modern psychological tests.

A graphic representation of the educational experience of the two general groups of students to which the College has accommodated itself is presented in Figure 1.

THE FOUR REGULAR CATEGORIES

It is the first object of this paper to describe the four regular categories of students including their elementary, secondary, and collegiate training.

ELEMENTARY CURRICULUM

All categories of students pass through the four year primary and three intermediate schools of the Philippine system. The subject content of these schools will not be considered. The primary schools are of one sort, while intermediate schools offer attempts at vocationization in farm, trade, and household arts. For entrance into the College of Agriculture, the character of intermediate curricula has been ignored. In Figure 1, two groups, Group I and Group II are led equally from the primary through and out of the intermediate brackets.

SECONDARY CURRICULA

The usual student of the College of Agriculture has experienced one of two types of secondary education. Following the indicated line in Figure 1, it will be found that Group I enters the four-year high school and Group II enters the two-year preparatory curriculum of the College of Agriculture. It will be profitable to compare these two types of secondary education in detail.

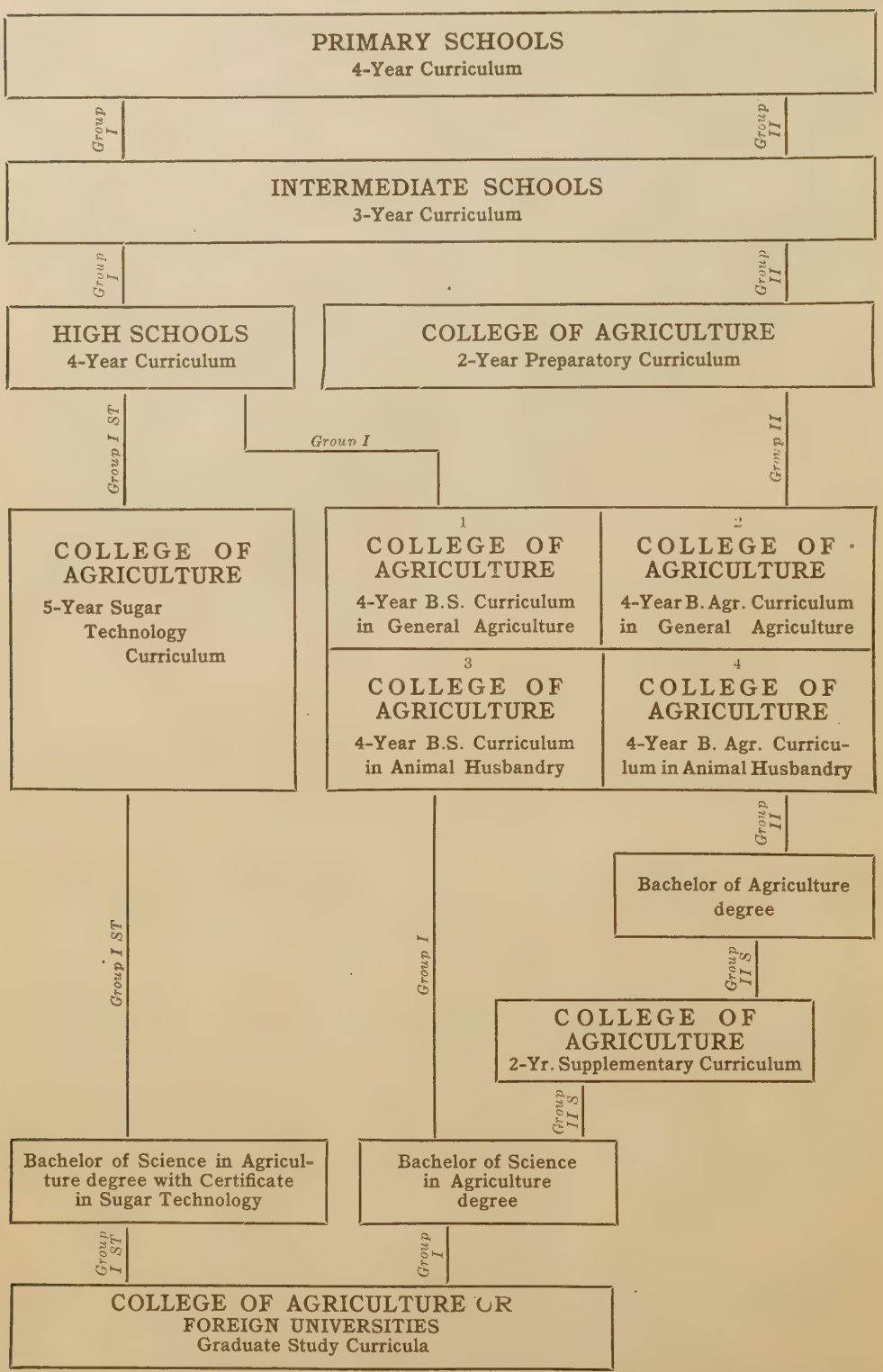

Fig. 1.—The Curricula of the College of Agriculture, University of the Philippines, and their relation to lower schools.

The general high school curriculum.—The general high school curriculum as prescribed for public and private secondary schools in the Philippines by the Department of Public Instruction is presented in Table I.[2]

TABLE I.—*General curriculum of Philippine High Schools.*

Year.	Subject.	Semesters.	Periods a week.*a*	Units.*b*
First	English Composition I	Both	5	10
	English Literature I	Both	4	8
	Current Events I	Both	1	2
	United States History	Both	3	6
	United States Government	Both	2	4
	Elementary algebra	Both	5	10
	Military drill	Both	2	*c*
	Group games and athletics	Both	3	*c*
Second	English composition II	Both	2	4
	English literature II	Both	3	6
	Physical geography	Both	5	10
	General history I	Both	4	8
	Current events II	Both	1	2
	Plane geometry	Both	5	10
	Military drill	Both	2	*c*
	Group games and athletics	Both	3	*c*
Third	English composition III	Both	2	4
	English literature III	Both	3	6
	Biology (botany and zoology)	Both	5D*d*	10
	General history II	Both	4	8
	Current events III	Both	1	2
	Advanced algebra	First	5	5
	Review arithmetic	Second	5	5
	Military drill	Both	2	*c*
	Group games and athletics	Both	3	*c*
Fourth	English composition IV	Both	2	4
	English literature IV	Both	3	6
	Economic conditions	Both	5	10
	Philippine history and government	Both	4	8
	Current events IV	Both	1	2
	Physics	Both	5D*d*	10
	Military drill	Both	2	*c*
	Group games and athletics	Both	3	*c*
All	All subjects			160

a Periods are of 40 minutes duration unless otherwise noted.

b One period a week for one semester equals one unit.

c Informal credit.

d D indicates double or laboratory period of 80 minutes duration but equivalent to one regular period in unit value.

[2] From the Office of the Director, Bureau of Education.

The preparatory curriculum.—The outline of the two-year preparatory curriculum of the College is presented in Table II.[3]

TABLE II.—*Preparatory curriculum of the College of Agriculture.*

Year.	Subject.	Semesters.	Periods a week.*a*	Units.*b*
First	English 1, *Composition*	Both	5	10
	Mathematics 1, *Elementary algebra*	Both	5	10
	Plant physiology 1, *Elementary botany*	Both	2+2T*c*	8
	Agronomy 1, *Field practice*	Both	2T*c*	4
	Rural economics 1, *Economic conditions*	Both	2	4
	Military science 1	Both	3	*d*
	Physical training 1	Both	1	*d*
Second	English 2, *Composition*	Both	5	10
	Mathematics 2, *Plane geometry*	Both	5	10
	Physics 1	Both	2+1T*c*	6
	Zoology 1	Both	3+2T*c*	10
	Military science 2	Both	3	*d*
	Physical training 2	Both	1	*d*
Both	All subjects			72

a Periods are of 55 minutes duration unless otherwise noted.

b One period a week for one semester equals one unit.

c T indicates triple or laboratory period of 175 minutes duration but equivalent to one regular period in unit value.

d Informal credit.

Comparison of academic subjects.—Considering the academic content of the two curricula—high school and two-year preparatory—and the difference in length of periods, a detailed comparison on a clock-hour basis, classified according to general subject matter, is given in Table III.

In further explanation of the comparison presented in Table III, it may be said that: (a) Mathematics 1 (*Elementary algebra*) in the College of Agriculture covers algebra and a part of advanced algebra in the high school, using the same text books; (b) Mathematics 2 (*Plane geometry*) covers the entire text which is only partially covered by plane geometry in the high school; (c) Plant Physiology 1 is practically a full year course in elementary botany in place of the first half of biology in the high school; (d) Zoology 1 is a full year course in place of the second half of biology in the high school; (e) Physics 1 covers the work of physics in the high school using the same text but effecting a saving in clock-time through small laboratory and quiz sections (10 to 15 students to the section); and (f) Rural Economics 1 covers the same field as economic conditions in the high school using the same basic text (Miller's *Economic Conditions of the Philippines*) but saving clock-time by small quiz sections (10 students to the section).

[3] From University of the Philippines Bulletin No. 10, page 356.

TABLE III.—*Comparison of the preparatory curriculum of the College of Agriculture, University of the Philippines, with the general curriculum of the high schools under the Philippine Bureau of Education.*

High school general curriculum.				College of agriculture preparatory curriculum.			
Subjects and courses.	Year.	Credits.*a*	Clock hours.*b*	Equivalent subjects and courses.	Year.	Credits.*c*	Clock hours.*b*
English Composition:				English Composition:			
Composition I	1	10	107	English 1	1	10	147
Composition II	2	5	53	English 2	2	10	147
Composition III	3	5	53			—	—
Composition IV	4	5	53				
All composition		25	266	All composition		20	294
English Literature:				English Literature:			
Literature I	1	8	85	Not given.			
Literature II	2	5	53				
Literature III	3	5	53				
Literature IV	4	5	53				
All literature		23	244				
Current events:				Current events:			
Current events I	1	2	21	Not given.			
Current events II	2	2	21				
Current events III	3	2	21				
Current events IV	4	2	21				
All current events		8	84				
History:				History:			
United States history	1	6	64	Not given.			
United States government	1	4	43				
General history	2	8	85				
General history	3	8	85				
Philippine history	4	8	85				
All history		34	362				
Mathematics:				Mathematics:			
Algebra	1	10	107	Mathematics 1 (*Algebra*)	1	10	147
Plane geometry	2	10	107	Mathematics 2 (*Plane geometry*)	2	10	147
Advanced algebra	3	5	53			—	—
Review arithmetic	3	5	53				
All methematics		30	320	All mathematics		20	294
Science:				Science:			
Physical geography	2	10	107	Agronomy 1	1	4	184
Biology (*Botany and zoology*)	3	10	213	Plant Physiology 1 (*Elementary botany*)	1	8	243
Physics	4	10	213	Zoology 1	2	10	293
				Physics 1	2	6	152
All science		30	533	All science		28	872
Economics:				Economics:			
Economic Conditions	4	10	107	Rural economics 1 (*Economic conditions*)	1	4	59
All subjects		160	1916	All subjects		72	1519

a A high school credit is taken as 40 minutes a week for 16 weeks in classroom or 80 minutes a week for 16 weeks in laboratory.

b Clock hours here given represent the actual time during the school year devoted to the subject.

c A College credit is taken as 55 minutes a week for 16 weeks in classroom or 175 minutes a week for 16 weeks in laboratory or field.

The inspection of Table III permits the following conclusions on the comparison of the co-ordinate courses:

(1) The College of Agriculture preparatory curriculum covers effectively the high school general curriculum except for literature, history, and current events—in short, it covers all the essentials of preparation for technical higher education.

(2) The College preparatory curriculum devotes slightly more time to English composition than does the high school general curriculum.

(3) The College preparatory curriculum devotes much more time to science than does the high school general curriculum.

(4) The College preparatory curriculum is "two years" in name and in over-all duration only, and not in substance, as it covers 80 per cent as much work on a clock-hour basis as does the four-year high school general curriculum.

(5) There can be no doubt but that the preparatory student in the College is forced to more rapid work and a greater number of hours of study for each day than is the high school student. The general plan of allowing an hour for home, library, and study-room preparation for each hour of class room or laboratory attendance, enables a computation which will bring out evidence on this point. Each of the 32 school weeks in the College includes six "study-days" or a total of 192 such days for each school year. This gives 384 study-days for the College preparatory student during his two years. Each of the 32 school weeks in the high school includes five study-days or a total of 168 such days for each school year. This gives 640 study-days for the high school student during the four years. The College preparatory curriculum requires 1519 class room or laboratory hours and an equal number of preparation hours—a total of 3038 or an average of about 8 hours for each study-day of the two years. The high school general curriculum requires 1916 class room or laboratory hours and an equal number of preparation hours—a total of 3832 hours or an average of almost 6 hours for each study-day of the four years.

The greater pushing might be criticised as too heavy a load for immature students to which is opposed the considerations that: (a) The medical officer attached to the College staff has found a remarkably high average health among the students; (b) The average age of preparatory students in the College is greater than the average age of high school students, although the latter age four years during attendance against two years for the former, a fact which would tend to increase the average age of high school students; (c) Greater mental maturity in the College preparatory student, regardless of age, is evidenced by the fact that he has passed into or through the "vocational shock"; (d) College preparatory students are able to proceed more rapidly in the class room due to the fact that they form a more selective group than the high school students, for, from a population of 11,000,000, there were approximately 30,000 high school students for the school year 1922-1923,[4] whereas there were but 200 agricultural preparatory students, and while the high schools promoted over 80 per cent of their students the College promoted less than 60 per cent of its preparatory students.

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[4] Twenty-third Report of the Director of Education.

THE COLLEGIATE CURRICULA

Referring again to Figure 1, following the line for Group I, it is found that upon leaving the high school the group splits into two sub-groups—Group I and Group I ST—for purposes of entrance into the College of Agriculture.

The curriculum in sugar technology.—Group I ST enters the five-year curriculum in sugar technology offered by the College and leading to the degree of Bachelor of Science in Agriculture with Certificate in Sugar Technology and permitting subsequent candidacy for Master of Science in Agriculture. The sugar technology curriculum consists of 176 units of work and two semesters of sugar mill practice. The fact that dynamics and calculus, which are included in the sugar schedule, demand a lengthy prerequisite sequence of mathematics, makes it impossible to articulate the sugar curriculum with the two-year preparatory, hence it is open only to those who have come through high school. Inasmuch as this curriculum is not involved in differential articulation with lower schools, present consideration of it may be dismissed.

The four-year curricula.—Group I, having come via the high school route, and Group II, having come via the preparatory route enter together the four-year curricula of the College of Agriculture. (See Figure 1.) There are four four-year curricula in the College which are arranged in both vertical and horizontal juxtaposition. The vertical juxtaposition holds for entrance and degree, that is: (1) and (3) are open to Group I, the high school graduates, and lead to the degree of Bachelor of Science in Agriculture; while (2) and (4) are open to Group II, the preparatory graduates, and lead to the degree of Bachelor of Agriculture. The horizontal juxtaposition holds for specialization, that is; (1) and (2) offer identical specialization in general agriculture, regardless of entrance or degree; while (3) and (4) offer identical specialization in animal husbandry, regardless of entrance or degree.

Comparison of Bachelor of Science and Bachelor of Agriculture general curricula.—In the introduction and again in the above paragraph, the practical identity of the Bachelor of Science and Bachelor of Agriculture curricula has been emphasized. The proof of this identity is developed in Table IV, wherein the identities are shown in plain type and the few differences, in black-faced type.

Explanations of the differences may be briefly given: (a) The preparatory graduate takes Mathematics 3 (*Advanced algebra*), 5 units, which is not required of the high school graduates who covered the subject in the third year of the high school. The presence of this subject in the Bachelor of Agriculture curriculum is admittedly an extension of work of a preparatory nature into the collegiate schedule. (b) The preparatory graduate takes English 3a (*Composition*), 5 units, which is not required of the high school graduate. This is also an extension of work of a preparatory nature into the collegiate schedule. (c) The preparatory graduate takes his collegiate composition under the designation, English 3b, 5

units, while the high school graduate takes his collegiate composition under the designation, English 4, 5 units. These two courses are to all intents and purposes the same, representing a pragmatic division of the two groups. (d) The high school graduate takes Agronomy 1 (*Field practice*), 4 units, which has already been covered by the preparatory graduate. As this course is distinctly elementary it may be taken as an extension of work of a preparatory nature into the collegiate schedule. (e) The high school graduate takes Zoology 1 (General), 10 units, which has already been covered by the preparatory graduate. This course would not be required of high school graduates were it not for the fact that the average high school course in biology is practically useless as a foundation for the intensive application of the biological sciences found in the agronomy, plant pathology, entomology, and animal husbandry divisions. The same argument might be made for the other half of high school biology—botany —as it will be noticed that the high school graduate is released from Plant Physiology 1 (*Elementary botany*) of the preparatory schedule. This inadequacy was at one time recognized and the high school graduate compelled to enter the College in the summer session prior to his freshman year for the purpose of relieving an "automatic condition" in botany. So much dissatisfaction resulted from this requirement that the plan was dropped and it is now left for those sections of Plant Physiology 2 which have high school graduates to informally remedy the shortcomings of their students in elementary botany. This compromise could not be made for the zoological end as no second course in zoology is provided in the collegiate schedules.

Summarizing the comparison between the Bachelor of Science in Agriculture, and Bachelor of Agriculture general curricula, it is apparent that the Bachelor of Science in Agriculture curriculum is composed of 164 units of work, of which 14 units (Agronomy 1 and Zoology 1) represent intrusion of preparatory work into the collegiate schedule, and 150 units represent the technical agricultural collegiate schedule. Similarly, it is apparent that the Bachelor of Agriculture curriculum is composed of 160 units of work, of which 10 units (Mathematics 3 and English 3a) represent intrusion of preparatory work into the collegiate schedule, and 150 units represent the technical agricultural collegiate schedule.

Finally, excepting the variant designation of the two courses in collegiate English Composition (English 4 in Bachelor of Science, and English 3b in Bachelor of Agriculture), the 150 technical collegiate units of the Bachelor of Science general curriculum and the 150 technical collegiate units of the Bachelor of Agriculture general curriculum *are identical.*

No apology for the intrusion of secondary material (the 14 units in Bachelor of Science, and the 10 units in Bachelor of Agriculture) need be made. The cause is the insufficient or the inapplicable character of the average high school work in biology which, although accepted for entrance, is not suitable for foundation of technical agriculture. And, while the high school graduate is removing his 14 units of informal "conditions," the preparatory graduate strengthens his preparatory mathematics and English by an additional 10 units, thus keeping the 150 collegiate units parallel for Bachelor of Science and Bachelor of Agriculture, both in sequence and chronologically.

Total technical units.—The total of 150 technical units required for the degrees Bachelor of Science in Agriculture and Bachelor of Agriculture, is greater than the number of units required for the Bachelor of Science degrees in other schools and colleges of the University of the Philippines, as is indicated in the following lists:

Curricula of the University	*Units*
Bachelor of Science in Agriculture	150
Bachelor of Agriculture	150
Bachelor of Science in Commerce	147
Bachelor of Science in Mechanical Engineering	145
Bachelor of Science in Civil Engineering	144
Bachelor of Science in Library Science	136
Bachelor of Science in Government	132
Bachelor of Science in Education	132
Bachelor of Science in Home Economics	126

Comparison of Bachelor of Science and Bachelor of Agriculture animal husbandry curricula.—To this point the discussion has centered on, and Table IV has presented, a comparison of the Bachelor of Science curriculum in general agriculture with the Bachelor of Agriculture curriculum in general agriculture, brackets (1) and (2) in Figure 1. Similar comparison of the Bachelor of Science curriculum in animal husbandry with the Bachelor of Agriculture curriculum in animal husbandry, brackets (3) and (4) in Figure 1, might be made with the following results:[5] (a) The differences between the Bachelor of Science animal husbandry and the Bachelor of Agriculture animal husbandry curricula are exactly the same as the differences between the Bachelor of Science general and Bachelor of Agriculture general curricula; (b) 150 units of the technical collegiate work in the Bachelor of Science animal husbandry and Bachelor of Agriculture animal husbandry schedules are identical, but differ considerably from the 150 units the two general curricula; (c) The first year collegiate of the Bachelor of Science general and the first year collegiate of the Bachelor of Science animal husbandry curricula are identical; and (d) The first year collegiate of the Bachelor of Agriculture general and the first year collegiate of the Bachelor of Agriculture animal husbandry curricula are identical.

SUPPLEMENTARY CURRICULUM

In Figure 1, Group I is further traced to its degree, Bachelor of Science in Agriculture, Group I ST, to the same degree with the addition of a Certificate in Sugar Technology, which degrees are articulated at the upper end with graduate study looking towards the degree Master of Science in Agriculture. At this point, both Group I and Group I ST may be dismissed.

Turning to Group II, it has been traced to its degree, Bachelor of Agriculture. This award is a true degree and not a diploma, due to the important consideration that the technical experience (the 150 hours in either specialization) of the Bachelor of Agriculture curriculum has been identical with that of the Bachelor of Science curriculum. The modification in nomenclature, as was suggested in the introduction, is to avoid confusion and to serve as a signal to those institutions, here and abroad, who hold rigidly to an eight years regimen supra elementary (four years secondary plus four years collegiate) as prerequisite to graduate work.

[5] For details of technical work in the animal husbandry schedules, see University of the Philippines Bulletin No. 10, pages 353 and 358.

TABLE IV.—*Comparison of the Bachelor of Science Curriculum (for high school graduates) and the Bachelor of Agriculture Curriculum (for preparatory graduates) of the College of Agriculture, University of the Philippines.*

[Identical subjects in plain type, differences in black-faced type.]

Bachelor of Science General Curriculum. (*For High School Graduates*)			Bachelor of Agriculture General Curriculum. (*For Preparatory Graduates.*)		
Courses.	1st sem. units.	2nd sem. units.	Courses.	1st sem. units.	2nd sem. units.
First year collegiate:			First year collegiate:		
English 4 (*College Composition*)	5		**Mathematics 3** (*Advanced Algebra*)	5	
Mathematics 5 (*Trigonometry*)		3	Mathematics 5 (*Trigonometry*)		3
Plant Physiology 2 (*Second Botany Course*)	4	4	Plant Physiology 2 (*Second Botany Course*)	4	4
Agricultural Chemistry 1 (*General*)	5	5	Agricultural Chemistry 1 (*General*)	5	5
Rural Economics 2 (*Rural Economy*)	3	3	Rural Economics 2 (*Rural Economy*)	3	3
Agronomy 1 (*Field Practice*)	2	2			
Agronomy 2 (*Agricultural Geology*)	3		Agronomy 2 (*Agricultural Geology*)	3	
Agronomy 3 (*Soils*)		5	Agronomy 3 (*Soils*)		5
All courses	22	22	All courses	20	20
Second year collegiate:			Second year collegiate:		
Zoology 1 (*General*)	5	5	**English 3a** (*Composition*)	5	
Agricultural Chemistry 2 (*Analytical*)	5	5	**English 3b** (*College Composition*)		5
Rural Economics 3 (*Farm Accounting*)	2	2	Agricultural Chemistry 2 (*Analytical*)	5	5
Physics 2 (*College Physics*)		5	Rural Economics 3 (*Farm Accounting*)	2	2
Agronomy 4 (*Principles of Production*)	5		Physics 2 (*College Physics*)		5
Agronomy 5 (*Survey of Production*)	5		Agronomy 4 (*Principles of Production*)	5	
Agronomy (*Elective*)		5	Agronomy 5 (*Survey of Production*)	5	
			Agronomy (*Elective*)		5
All courses	22	22	All courses	22	22
Third year collegiate:			Third year collegiate:		
Entomology 1 (*General*)	5		Entomology 1 (*General*)	5	
Plant Pathology 1 (*General*)		5	Plant Pathology 1 (*General*)		5
Agronomy (*Elective*)	5	5	Agronomy (*Elective*)	5	5
Rural Engineering 1a (*Mechanics*)	4		Rural Engineering 1a (*Mechanics*)	4	
Rural Engineering 1b (*Farm Machinery*)		3	Rural Engineering 1b (*Farm Machinery*)		3
Rural Engineering 1c (*Surveying*)		1	Rural Engineering 1c (*Surveying*)		1
Major	5	5	Major	5	5
All courses	19	19	All courses	19	19
Fouth year collegiate:			Fourth year collegiate:		
Animal Husbandry 1 (*General*)	4	4	Animal Husbandry 1 (*General*)	4	4
Elective	5	5	Elective	5	5
Major	10	10	Major	10	10
All courses	19	19	All courses	19	19
All years	82	82	All years	80	80

Origin.—It was originally thought that the small number of graduates of the College whom it would be desirable to send to institutions of higher learning abroad would come largely from the Bachelor of Science curricula. But almost from the very beginning, the Bachelor of Agriculture curricula produced the greater number of candidates for higher technical specialization, the more obvious cause for this being their preponderant number of the total enrollment. Some universities in the United States—Wisconsin, Johns Hopkins and Chicago among them—were willing to accept the Bachelor of Agriculture graduate with his acknowledged shortage of two years' work in preparatory literature and history as candidates for Master's degrees. However, as the number of candidates for Master's degrees from this and other colleges of the Philippine Islands increased, there was a tendency to tighten entrance to candidacy. When the University of the Philippines established its own Master's system it ruled against the Bachelor of Agriculture graduates. It became necessary to remedy a condition which barred a select but important few of the Bachelors of Agriculture from higher degrees.

Composition.—The task of formally preparing Bachelors of Agriculture for Master's work was accomplished by carrying a selected few of Group II, who are designated in Figure 1 as Group II S, through a supplementary curriculum which is composed as follows:

Subject Groups.	*Units.*
History electives	20
English literature and higher composition electives	10
Optional academic electives	20
Optional academic or technical electives	10
All subjects	60

The work normally takes two years and, upon satisfactory completion, the degree of Bachelor of Agriculture is raised to the degree of Bachelor of Science in Agriculture, thus removing the barrier to candidacy which exists under present standards of graduate study.

The College offers several academic courses for the supplementary schedule, as follows:

Courses.	*Units.*
History 1 (General history of Europe)	10
History 2 (American history)	5
History 3 (Federal and Insular government)	5
History 4 (Philippine history)	5
History 5 (Oriental history)	5
English 11 (Advanced collegiate composition)	6
English 12 (English literature)	5
English 13 (General literature)	6
French 1 (Beginning French)	6
French 2 (Intermediate French)	6
German 1 (Beginning German)	6
German 2 (Intermediate German)	6
Spanish 1 (Beginning Spanish)	6
Spanish 2 (Intermediate Spanish)	6
All courses	83

From these 83 units the student in the supplementary curriculum selects at least 50 units and from any of the scientific and technical courses which he has not presented for the Bachelor of Agriculture degree, he may select not more than 10 units. With the consent of the Dean of the College, the supplementary curriculum may be pursued in any accredited high school or in the classical colleges, provided always that the student working in the supplementary curriculum shall not present for credit subjects duplicating in substance any of the subjects offered for the degree of Bachelor of Agriculture.

From the standpoint of theoretical pedagogy, the supplementary curriculum may not be altogether defensible. However, it aptly meets a situation which could not be avoided. The vigor, intelligence, and success with which mature men undertake their delayed experience in the liberal arts, throws doubt upon some precedents in modern education. The number of students admitted to the supplementary curriculum is very limited. It will be perceived at once that it represents an effort—so far, very successful—to maintain upper end articulation in spite of the broad entrance policy.

THE FARM EXPERIENCE CURRICULUM

To avoid confusion, no mention has been made of the curriculum in farm experience which occupies one long recess (8 to 10 weeks); is required of all undergraduate students, except those specializing in sugar technology, (Group I ST); and is composed as follows:

Subject.	*Hours a week.*
Farm experience A (*Seasonal practice*)	15
Farm experience B (*Blacksmithing*)	9
Farm experience C (*Carpentry*)	9
All subjects	33

The work is usually taken by the high school graduates, Group I, during the recess between first and second collegiate years and by the intermediate school graduates, Group II, during the recess between first and second preparatory years. The curriculum is a common factor and does not effect the entrance regulations.

SUMMARY OF REGULAR CATEGORIES

Thus far four regular categories of students have been taken through their educational experience to their respective degrees. They may be summed up as follows:

Group I:—Primary school (4 years); Intermediate school (3 years); General high school (4 years); College of Agriculture curricula with specialization in either general agriculture or animal husbandry including the farm experience curriculum (4 years); Granted the degree of *Bachelor of Science in Agriculture;* Prepared for graduate study.

Group I ST:—Primary school (4 years); Intermediate school (3 years); General high school (4 years); College of Agriculture technical curriculum in sugar technology (5 years); Granted the degree of *Bachelor of Science in Agriculture* with *Certificate in Sugar Technology;* Prepared for graduate study.

Group II:—Primary school (4 years); Intermediate school (3 years); College of Agriculture preparatory and farm experience curricula (2 years); College of Agriculture technical curricula with specialization in either general agriculture or animal husbandry (4 years); Granted the degree of *Bachelor of Agriculture;* Not generally admitted to graduate study.[6]

[6]Whether or not Group II is prepared for graduate study is a matter of opinion.

Group II S:—Primary school (4 years); Intermediate school (3 years); College of Agriculture preparatory and farm experience curricula (2 years); College of Agriculture technical curricula with specialization in either general agriculture or animal husbandry (4 years); Granted the degree of *Bachelor of Agriculture;* College of Agriculture (or elsewhere) supplementary curriculum (2 years); Granted the degree of *Bachelor of Science in Agriculture;* Prepared for graduate study

Of these groups, the bulk of the students form Group II; about 20 per cent form Group I; about 4 per cent form Group II S; and less than 2 per cent form Group I ST.

Group II S has produced the greater number of pensionados whose successful higher education has enabled the building up of a Filipino faculty—perhaps the most important task during the first decade of the existence of the College of Agriculture.

SPECIAL CATEGORIES

Under *The Four Regular Categories* the articulation of the College was with the completion of the four year *general* high school course (Groups I and I ST) and with the completion of the intermediate school (Groups II and II S). Since the establishment of the College there has been an elaboration of secondary curricula in the Philippine system in the way of agricultural, normal, trade, and commercial high schools. These special high schools are reckoned as vocational ends in themselves and the authorities of the Bureau of Education have never encouraged the output of such institutions to undertake university work. Nor has the College itself intentionally influenced their graduates to shift. Nevertheless, graduates of special schools are applying in increasing numbers for admission to the College. In harmony with the broad entrance policy, these are allowed to enter under certain conditions. The graduates of each of these special schools must be conditioned in one or more subjects and consequently they form special categories.

In addition to articulation with special high schools, the College has encountered an ever increasing number of students who have completed one or more years, but have not graduated from the high school. That high schools in the Philippines are over-crowded; that they are located one in each provincial capital whither the students from outside the capital must travel and where they must pay in board and lodging as much if not more than in living at the College of Agriculture; that the students of the general high schools maintain certain fictitious and expensive standards of living, especially in clothing and social affairs, which are notably absent at the College; that there are exceptional opportunities for partial self-support at the College which do not exist in any except the agricultural high schools; that the College is manned by instructors, even in its preparatory curriculum of far higher attainments than the instructors of the average high school; that the College is a college and has the prestige of being a part of the one and only state university of the Islands, a prestige shared by the preparatory as well as collegiate classes; and perhaps more frequently than one might credit, that the student while in high school makes his genuine vocational choice —all these facts are reasons for the shifting from third, second, and first years of high schools to the College.

There are those who would check what they term "uneconomic shifting" by denying admission of the "shifters" to the College. But the faculty of the College think otherwise. They assume a hands-off policy because; (a) Perhaps

a delayed vocational choice is more sound than a previous immature one; (b) Greater human waste may result from refusing aid in rectifying an alleged mistake in vocational choice than in permitting re-education; and (c) No impediment, however slight, should be placed in the way of agricultural education in a country emphatically agricultural in interest.

GENERAL HIGH SCHOOL CATEGORIES

Completion of general high school.—Graduates of general high schools form Groups I and I ST of the regular categories described above.

Completion of third year.—Students who have completed with satisfactory ratings the third year in general high schools form Group I 3 and are admitted to the Bachelor of Science curriculum conditioned in Rural Economics 1, and Physics 1,

Group I 3 should complete the Bachelor of Science curriculum in five years.

Completion of second year.—Students who have completed with satisfactory ratings the second year of general high schools form Group I 2 and are admitted to the preparatory curriculum with advanced standing as follows:

H. S. Subjects.	*H. S. units.*	*Credited in C. A. as*	*C. A. units*
English composition I	10	English 1	10
Algebra	10	Mathematics 1	10
English composition II	10	English 2	10
Plane geometry	10	Mathematics 2	10

Group I 2 should complete the preparatory curriculum in one year, after which they may enter the Bachelor of Agriculture curriculum which they should complete in the regular four years. If subsequently, any of these students desire to work in the supplementary curriculum, thus forming Group I 2S, they are given advanced standing therein as follows:

H. S. Subjects.	*H. S. units.*	*Credited in C. A. as*	*C. A. units.*
English literature I	8	Supplementary English	10
Current events I	2		
United States history	6	Supplementary history	20
United States government	4		
General history I	8		
Current events II	2		
Physical geography	10	Supplementary academic	10

Group I 2S should complete the supplementary curriculum, thereby attaining the degree Bachelor of Science in Agriculture, in one year.

Completion of first year.—Students who have completed with satisfactory ratings the first year of general high schools form Group I 1 and are admitted to the preparatory curriculum with advanced standing as follows:

H. S. Subjects.	*H. S. units.*	*Credited as*	*C. A. units.*
English composition I	10	English 1	10
Algebra	10	Mathematics 1	10

Group I 1 should require the usual two years to complete the preparatory curriculum after which they may enter the Bachelor of Agriculture curriculum which they should complete in the regular four years. If subsequently, any of

these students desire to work in the supplementary curriculum, forming Group I 1S, they are given advanced standing therein as follows:

H. S. Subjects.	*H. S. units.*	*Credited as*	*C. A. units.*
English literature I	8	Supplementary English	10
Current events I	2		
United States history	6	Supplementary history	10
United States government	4		

Group I 1S should complete the supplementary curriculum, thereby attaining the degree of Bachelor of Science in Agriculture, in one year.

AGRICULTURAL HIGH SCHOOL CATEGORIES

The Bureau of Education has established several secondary courses in agriculture which aim through empirical teaching of the arts of husbandry to hasten settlement of the great unplowed domain. These schools were designed as vocational entities and it was not expected that their graduates would go further in their education. Inevitably, a few of their brighter graduates have wished to undertake scientific agriculture in the College. Moreover, some of the students of these special schools in the lower years have shifted. In general, the students coming from agricultural high schools to the College have represented an exceptionally valuable source of entrance material, being firm in their vocational choice, "broken" to the soil, and equipped with a valuable, if non-technical, introduction to agriculture.

These schools are commonly termed "of the Muñoz type" after the town of Muñoz, Nueva Ecija, where the first and most noted of the agricultural high schools is located. The curriculum of these schools is outlined in Table V.[7]

To the proper articulation of the foregoing curriculum with the curricula of the College of Agriculture, no little time was given. Several committee and conference sessions were held both at Muñoz and Los Baños. There was no difficulty in accepting graduates or students from Muñoz in the preparatory curriculum at the College, but the authorities at Muñoz, overlooking for the moment the fact that their school is a vocational entity and not a university preparatory school, could see no reason why students so well trained in agriculture should require six years to attain the Bachelor of Agriculture degree at the College when graduates of general high schools who have been "weaned away from the soil" should require but four years to attain the Bachelor of Science degree.

The real reason lay in the fact that although the Muñoz student had taken horticulture, farm management, field crops, animal husbandry, farm engineering, etc., subjects exactly similar in name to the technical subjects of the College, these subjects had not been preceded by mathematics and the fundamental sciences. For this reason they were entirely dogmatic in their content, whereas similarly titled work at the College is critical in content and intimately bound up with basic natural and biological sciences. The Muñoz student had not had the three year sequence of mathematics (algebra and plane geometry) and physics which fits the student entering the technical curricula of the College to immediately undertake chemistry and plant physiology as a basis for scientific agriculture. And the general high school graduate had completed precisely this important mathematico-physical sequence which is the accepted *sine quo non* of technical instruction. Hence, while the agricultural high school as constituted might admirably prepare boys for the transcendant purpose of becoming homesteaders of limited areas, and while it might turn out finely charactered, hard working graduates, it could not in any sense specifically prepare for scientific or technical agriculture.

7 From the Office of the Director, Bureau of Education, Manila.

TABLE V.—*Curriculum of Philippine agricultural high schools.*

Year.	Subject.	Periods a week.[a]	Units.[b]
First.....	English I.....	5	10
	Farm arithmetic.....	5	10
	Horticulture or Farm engineering I.....	5	10
	Physical education.....	2	[c]
	Field work I.....	24[d]	10
Second....	English II.....	5	10
	Civic biology.....	5D[e]	10
	Animal husbandry or Farm engineering II.....	5	10
	Physical education.....	2	[c]
	Field work II.....	24[d]	10
Third.....	English III.....	1	10
	Farm entomology.....	5D[e]	10
	Farm crops or Farm management I or Farm engineering III.....	5	10
	Physical education.....	2	[c]
	Field work III.....	24[d]	10
Fourth....	English IV.....	5	10
	Farm physics.....	5D[e]	10
	Extension work or Farm management II or Farm engineering IV.....	5	10
	Physical education.....	2	[c]
	Field work IV.....	24[d]	10
All.....	All subjects.....	.....	160

[a] Periods are of 40 minutes duration, unless otherwise noted.
[b] One period a week for one semester equals one unit. All subjects in this curriculum hold for the entire year.
[c] Informal credit.
[d] Arbitrarily, 2.4 hours in the field is here taken as equal to one unit.
[e] D indicates double or laboratory period of 80 minutes duration but equivalent to one regular period in unit value.

The College had no desire to "steal" the graduates of Muñoz nor to discourage them from re-education in technical agriculture, provided they cared to make the sacrifice of time which conditions necessitated. On the other hand, Muñoz authorities were highly desirous of sending a nucleus of graduates to the College that they might return as instructors—realizing that although their own courses could be taught empirically, they should be taught not by empiricists but by technologists.[8]

[8] See Report of President's Committee on Co-ordination between the College of Agriculture and the Central Luzon (Muñoz) Agricultural School. Los Baños, 1922.

Arrangements for articulation were effected in 1922 and stand as follows:

Completion of agricultural high school.—Graduates of agricultural high schools form Group III and are admitted to the Bachelor of Science curriculum conditioned in Mathematics 1, 2, and 3, and Physics 1, but with advanced standing as follows:

H. S. subjects.	*H. S. units.*	*Credited as*	*C. A. units*
Horticulture	10	Agronomy 1	4
Field work I	10	Farm experience A, Farm experience B, Farm experience C	Informal

Group III should complete the Bachelor of Science curriculum in five years by taking maximum advantage of summer sessions.

Completion of third year.—Students who have completed with satisfactory ratings the third year of agricultural high schools form Group III 3 and are admitted to the Bachelor of Science curriculum conditioned in Mathematics 1, 2, and 3, Physics 1, and Rural Economics 1, but with advanced standing as in the case of graduates forming Group III. They also should complete the Bachelor of Science curriculum in five years.

Completion of second year.—Students who have completed with satisfactory ratings the second year of agricultural high schools form III 2 and are admitted to the preparatory curriculum with advanced standing as follows:

H. S. subjects.	*H. S. units.*	*Credited as*	*C. A. units.*
English I	10	English 1	10
English II	10	English 2	10
Civic biology	10	Plant physiology 1	8
Horticulture	10	Agronomy 1	4
Field work I	10	Farm experience A, Farm experience B, Farm experience C	Informal

Group III 2 should complete the preparatory curriculum in one year, after which they may enter the Bachelor of Agriculture curriculum which they should complete in the regular four years. If subsequently, any of these students desire to work in the supplementary curriculum, forming Group III 2S, they are given advanced standing therein as follows:

H. S. subject.	*H. S. units.*	*Credited as*	*C. A. units*
Farm arithmetic	10	Supplementary academic	10
Field work II	10	Supplementary technical	10

Group III 2S should complete the supplementary curriculum, thereby attaining the degree Bachelor of Science in Agriculture, in one year.

Completion of first year.—Students who have completed with satisfactory ratings the first year of agricultural high schools form Group III 1 and are admitted to the preparatory curriculum with advanced standing as follows:

H. S. subjects.	*H. S. units.*	*Credited as*	*C. A. units.*
English I	10	English 1	10
Horticulture	10	Agronomy 1	4
Field work I	10	Farm experience A, Farm experience B, Farm experience C	Informal

Group III 1 should require the usual two years to complete the preparatory curriculum, after which they may enter the Bachelor of Agriculture curriculum which they should complete in the regular four years. If subsequently, any of these students desire to work in the supplementary curriculum, forming Group III 1S, they are given advanced standing therein as follows:

H. S. subjects.	*H. S. units.*	*Credited as*	*C. A. units*
Farm arithmetic	10	Supplementary academic	10

Group III 1S should require the usual two years to complete the supplementary curriculum, thereby attaining the degree Bachelor of Science in Agriculture.

COMMERCIAL HIGH SCHOOL CATEGORIES

In recent years the Bureau of Education has established a commercial curriculum in several high schools. The subject matter of this curriculum is shown in Table VI.[9]

Students, both graduates and under-graduates from the commercial high schools have entered the College. The curriculum differs in the third and fourth years from the general high schools, particularly in omitting advanced algebra, biology, and physics. In consequence, special categories were set up as described below.

Completion of commercial high school.—Graduates of commercial high schools form Group IV and are admitted to the Bachelor of Science curriculum conditioned in Mathematics 3, Plant Physiology 1, and Physics 1, but without advanced standing. The group should complete the curriculum in four years by taking maximum advantage of summer sessions.

Completion of third year.—Students who have completed with satisfactory ratings the third year of commercial high schools form Group IV 3 and are admitted to the Bachelor of Science curriculum conditioned in Mathematics 3, Plant Physiology 1, Physics 1, and in Rural Economics 1, but without advanced standing. The group should complete the curriculum in five years by taking maximum advantage of summer sessions.

Completion of second or first years.—The first two years of the commercial high schools being identical with the first two years of the general high schools, transfers from the first or second years commercial are treated in the same manner as transfers from the first or second years general. (See pages 498-99).

[9] From the Office of the Director, Bureau of Education.

TABLE VI.—*Curriculum of Philippine commercial high schools.*

Year.	Subject.	Semesters.	Periods. a week.*a*	Units.*b*
First	English composition I	Both	5	10
	English literature I	Both	4	8
	Current events I	Both	1	2
	United States history	Both	3	6
	United States government	Both	2	4
	Elementary algebra	Both	5	10
	Military drill	Both	2	*c*
	Group games and athletics	Both	3	*c*
Second	English composition II	Both	2	4
	English literature II	Both	3	6
	Physical geography	Both	5	10
	General history I	Both	4	8
	Current events II	Both	1	2
	Plane geometry	Both	5	10
	Military drill	Both	2	*c*
	Group games and athletics	Both	3	*c*
Third	Business English I	Both	4	8
	Readings I	Both	1	2
	General history II	Both	4	8
	Current events III	Both	1	2
	Commercial geography	First	5	5
	Commercial arithmetic	Second	5	5
	Stenography I or Bookkeeping I	Both	5	10
	Penmanship and Typewriting I	Both	4	8
	Spelling I	Both	1	2
Fourth	Business English II	Both	4	8
	Readings II and Current events IV	Both	1	2
	Economic conditions	Both	5	10
	Commercial law and Business methods	Both	5	10
	Stenography II or Bookkeeping II or Both	Both	5	10
	Typewriting II and Spelling II	Both	5	10
All	All subjects			180

a Periods are of 40 minutes duration.
b One period a week for one semester equals one unit.
c Informal credit.

SECONDARY TRADE SCHOOL CATEGORIES

One of the strongest secondary institutions in the Philippine system is the Philippine School of Arts and Trades located in Manila. This school operates a special curriculum. Several of the provincial schools, notably those of Cebu and Leyte, also maintain secondary trade schools.

The subject matter of the secondary trade schools is given in Table VII.[10] Details of the academic subjects only are given in Table VII, as the technical drafting, shop, and woodwork courses are of no special interest to the College of Agriculture, except as a basis for advanced standing in Farm experience B (*Blacksmithing*) and C (*Carpentry*) which is granted every student transferring from secondary trade schools regardless of the specific nature of his technical shop work.

TABLE VII.—*Curriculum of secondary trade schools.*

Year.	Subject.	Semesters.	Periods a week.*a*	Units.*b*
First.....	English composition I.....	Both	5	10
	English literature I.....	Both	5	10
	Elementary algebra.....	Both	5	10
	Shop work I.....	Both	*c*	*c*
Second....	English composition II.....	Both	2	4
	English literature II.....	Both	3	6
	General history.....	Both	5	10
	Plane geometry.....	Both	5	10
	Shop work II.....	Both	*c*	*c*
Third.....	English composition III.....	Both	2	4
	English literature III.....	Both	3	6
	Mechanics.....	Both	5	10
	Advanced algebra.....	First	5	5
	Review arithmetic.....	Second	5	5
	Shop work III.....	Both	*c*	*c*
Fourth....	English composition IV.....	Both	2	4
	English literature IV.....	Both	3	6
	Physics.....	Both	5	10
	Solid geometry.....	First	5	5
	Trigonometry.....	Second	5	5
	Shop work IV.....	Both	*c*	*c*
All.....	All academic subjects.....	.....	.....	120

a Periods are of 40 minutes duration.
b One period a week for one semester equals one unit.
c Periods and credits not detailed. Reader is referred to Bureau of Education Bulletin No. 43.

The College has found it necessary to list special categories for students transferring from these schools and from various years thereof, as follows:

[10] From Bureau of Education Bulletin No. 43. 1917.

Completion of secondary trade schools.—Graduates of secondary trade schools form Group V and are admitted to the Bachelor of Science curriculum conditioned in Plant Physiology 1, but with advanced standing as follows:

H. S. subjects.	*H. S. units.*	*Credited as*	*C. A. units.*
Solid geometry	5	Mathematics 6	3
Trigonometry	5	Mathematics 5	3
Shop work I	Informal	Farm experience B, Farm experience C	Informal

Group V should complete the Bachelor of Science curriculum in four years.

Completion of third year.—Students who have completed with satisfactory ratings the third year of secondary trade schools form Group V 3 and are admitted to the Bachelor of Science curriculum conditioned in Plant Physiology 1, Physics 1, and Rural Economics 1, but with advanced standing as follows:

H. S. subjects.	*H. S. units.*	*Credited as*	*C. A. units.*
Shop work I	Informal	Farm experience B, Farm experience C	Informal

Group V 3 should complete the Bachelor of Science curriculum in five years.

Completion of second year.—Students who have completed with satisfactory ratings the second year of secondary trade schools form Group V 2 and are admitted to the preparatory curriculum with advanced standing as follows:

H. S. subjects.	*H. S. units.*	*Credited as*	*C. A. units.*
English composition I	10	English 1	10
Elementary algebra	10	Mathematics 1	10
Shop work I	Informal	Farm experience A, Farm experience B	Informal
English composition II, English literature II	4, 6	English 2	10
Plane geometry	10	Mathematics 2	10

Group V 2 should complete the preparatory curriculum in one year, after which they may enter the Bachelor of Agriculture curriculum which they should complete in the regular four years. If subsequently, any of these students desire to work in the supplementary curriculum, thus forming Group V 2S, they are given advanced standing therein as follows:

H. S. subjects.	*H. S. units.*	*Credited as*	*C. A. units.*
English literature I	10	Supplementary English	10
General history	10	Supplementary history	10
Shop work II	Informal	Supplementary technical	10

Group V 2S should complete the supplementary curriculum, thereby attaining the degree Bachelor of Science in Agriculture, in one year by taking maximum advantage of summer sessions.

Completion of first year.—Students who have completed with satisfactory ratings the first year of secondary trade schools form Group V 1, and are admitted to the preparatory curriculum with advanced standing as follows:

H. S. subjects.	*H. S. units.*	*Credited as*	*C. A. units.*
English composition I	10	English 1	10
Elementary algebra	10	Mathematics 1	10
Shop work I	Informal	Farm experience B, Farm experience C	Informal

Group V 1 should require the usual two years to complete the preparatory curriculum after which they may enter the Bachelor of Agriculture curriculum which they should complete in the regular four years. If subsequently, any of these students desire to work in the supplementary curriculum, thus forming Group V 1S, they are given advanced standing therein as follows:

H. S. subjects.	*H. S. units.*	*Credited as*	*C. A. units.*
English literature 1.....	10	Supplementary English...	10

Group V 1S, should require the usual two years to complete the supplementary curriculum, thereby attaining the degree Bachelor of Science in Agriculture.

TWO-YEAR NORMAL SCHOOL CATEGORIES

There are a limited number of two-year normal school courses in the provincial secondary schools of the Philippines. The curriculum is given in Table VIII.[11]

TABLE VIII.—*Curriculum of two year normal schools.*

Year.	Subjects.	Semesters.	Periods a week.*a*	Units.*b*
First.....	English composition I.....	Both	5	10
	English literature I.....	Both	4	8
	Current events I.....	Both	1	2
	United States history.....	Both	3	6
	United States government.....	Both	2	4
	Advanced arithmetic.....	Both	5	10
	Industrial work.....	Both	2+3D*c*	10
	Music.....	Both	2	4
	Physical education I.....	Both	3	6
Second....	English composition II.....	Both	2	4
	English literature II.....	Both	3	6
	Advanced reading.....	Both	5	10
	Psychology.....	First	5	5
	Methods.....	Second	5	5
	Physical geography.....	First	5	5
	Advanced geography.....	Second	5	5
	Observation and teaching.....	Both	5D*c*	10
	Physical education II.....	Both	3	6
Both.....	All subjects.....	.....	.....	116

a Periods are of 40 minutes duration unless otherwise noted.

b One period a week for one semester equals one unit.

c D indicates double or laboratory period of 80 minutes duration but equivalent to one regular period in unit value.

[11] From the Office of the Director, Bureau of Education, Manila.

Completion of two-year normal courses.—Students who have completed the two-year normal course form Group VI 2 are admitted to the preparatory curriculum with advanced standing as follows:

H. S. subjects.	*H. S. units.*	*Credited as*	*C. A. units.*
English composition I	10	English 1	10
English composition II	4	English 2	10
English literature II	6		

Group VI 2 should require the usual two years to complete the preparatory curriculum, after which they may enter the Bachelor of Agriculture general curriculum which they should complete in the regular four years. If subsequently, any of these students desire to work in the supplementary curriculum, thus forming Group VI 2S, they are given advanced standing therein as follows:

H. S. subjects.	*H. S. units.*	*Credited as*	*C. A. units.*
English literature 1	8	Supplementary English	10
Current events	2		
United States history	6	Supplementary history	10
United States government	4		
Advanced arithmetic	10	Supplementary academic	30
Advanced reading	10		
Physical geography	5		
Advanced geography	5		

Group VI 2S lack only 10 units of supplementary history. If their collegiate scholarship is good, they may be permitted in their last year of the Bachelor of Agriculture curriculum to take History 1 (General history) 10 units, in addition to their regular work, thus completing the supplementary curriculum simultaneously with the Bachelor of Agriculture curriculum, in which case they will be given the one degree, Bachelor of Science in Agriculture.

Completion of the first year.—Students who have completed with satisfactory ratings the first year of the two-year normal course form Group VI 1 and are admitted to the preparatory curriculum with advanced standing as follows:

H. S. subjects.	*H. S. units.*	*Credited as*	*C. A. units.*
English composition I	10	English 1	10

Group VI 1 should require the usual two years to complete the preparatory curriculum, after which they may enter the Bachelor of Agriculture curriculum, which they should complete in the regular term of four years. If subsequently, any of these students desire to work in the supplementary curriculum, thus forming Group VI 1S, they are given advanced standing therein as follows:

H. S. subjects.	*H. S. units.*	*Credited as*	*C. A. units.*
English literature I	8	Supplementary English	10
Current events I	2		
United States history	6	Supplementary history	10
United States government	4		
Advanced arithmetic	10	Supplementary academic	10
Industrial work	10	Supplementary technical	10

Group VI 1S should complete the supplementary curriculum, thereby attaining the degree Bachelor of Science in Agriculture, in one year.

FOUR-YEAR NORMAL SCHOOL CATEGORIES

There are several four year normal school courses in the provincial secondary schools of the Philippines. The curriculum is given in Table IX.[12]

[12] From the Office of the Director, Bureau of Education.

TABLE IX.—*Curriculum of the four-year normal schools.*

Year.	Subjects.	Semesters.	Periods a week.a	Units.b
First.....	English composition I.....	Both	5	10
	English literature I.....	Both	4	8
	Current events I.....	Both	1	2
	United States history.....	Both	3	6
	United Stated government.....	Both	2	4
	Advanced arithmetic.....	Both	5	10
	Industrial work.....	Both	3Dc	6
	Drawing.....	Both	2Dc	4
	Physical education I.....	Both	3	6
Second....	English composition II.....	Both	2	4
	English literature II.....	Both	3	6
	Advanced reading.....	Both	5	10
	General history I.....	Both	4	8
	Current events II.....	Both	1	2
	Physical geography.....	First	5	5
	Advanced geography.....	Second	5	5
	Elementary algebra.....	Both	5	10
	Physical education II.....	Both	3	6
Third.....	English composition III.....	Both	2	4
	English literature III.....	Both	3	6
	Biology.....	Both	5Dc	10
	General history II.....	Both	4	8
	Current events III.....	Both	1	2
	Psychology.....	First	5	5
	General methods.....	Second	5	5
	Music.....	Both	3	6
	Writing.....	Both	2	4
	Observation.....	Both	3	6
Fourth....	English composition IV.....	Both	2	4
	English literature IV.....	Both	3	6
	Economic conditions.....	Both	5	10
	Philippine history and government.....	First	4	4
	Current events IV.....	First	1	1
	Physiology, hygiene, and sanitation.....	Second	5	5
	School management.....	First	5	5
	History of education.....	Second	5	5
	Observation and teaching II.....	Both	5Dc	10
	Physical education III.....	Both	3	6
All.....	All subjects.....	.....	.....	224

a Periods are of 40 minutes duration unless otherwise noted.

b One period a week for one semester equal one unit.

c D indicates double or laboratory period of 80 minutes duration but equivalent to one regular period in unit value.

Completion of the four-year normal course.—Graduates of the four-year normal course form Group VII and are admitted to the Bachelor of Science curriculum conditioned in Mathematics 2, and 3 and Physics 1. They should complete the curriculum in five years.

Completion of the third year.—Students who have completed with satisfactory ratings the third year of four-year normal schools, form Group VII 3 and are admitted to the Bachelor of Science curriculum conditioned in Mathematics 2 and 3, Physics 1, and Rural Economics 1. They should complete the curriculum in five years.

Completion of the second year.—Students who have completed with satisfactory ratings the second year of the four-year normal schools, form Group VII 2 and are admitted to the preparatory curriculum with advanced standing as follows:

H. S. subjects.	*H. S. units.*	*Credited as*	*C. A. units.*
English composition I	10	English 1	10
English composition II	4	English 2	10
English literature II	6		
Elementary algebra	10	Mathematics 1	10

Group VII 2 should require one year to complete the preparatory curriculum, after which they may enter the Bachelor of Agriculture curriculum which they should complete in the regular four years. All students in Group VII 2 are registered during their fourth year of the Bachelor of Agriculture curricula in the supplementary curriculum, thus forming, also, Group VII 2S. They are given advanced standing in the supplementary curriculum as follows:

H. S. subjects.	*H. S. units.*	*Credited as*	*C. A. units.*
English literature I	8	Supplementary English	10
Current events I	2		
United States history	6	Supplementary history	20
United States government	4		
General history I	8		
Current events II	2		
Advanced arithmetic	10	Supplementary academic	20
Physical geography	5		
Advanced geography	5	Supplementary technical	10
Industrial work	6		
Drawing	4		

The advanced standing scheduled above amounts to the entire requirement of the supplementary curriculum with the result that Group VII 2S automatically completes the supplementary curriculum simultaneously with the Bachelor of Agriculture curriculum and are consequently recommended for the one degree, Bachelor of Science in Agriculture.

Completion of the first year.—Students who have completed with satisfactory ratings the first year of the two-year normal course form Group VII 1 and are admitted to the preparatory curriculum with advanced standing as follows:

H. S. subjects.	*H. S. units.*	*Credited as*	*C. A. units.*
English composition I	10	English 1	10

Group VII 1 should require the usual two years to complete the preparatory curriculum, after which they may enter the Bachelor of Agriculture curriculum,

which they should complete in the regular term of four years. If subsequently, any of these students desire to work in the supplementary curriculum, thus forming Group VII 1S, they are given advanced standing therein as follows:

H. S. subjects.	*H. S. units.*	*Cerdited as*	*C. A. units.*
English literature I	8	Supplementary English	10
Current events I	2		
United States history	6	Supplementary history	10
United States government	4		
Advanced arithmetic	10	Supplementary academic	10
Industrial work I	6	Supplementary technical	10
Drawing	4		

Group VII 1S should complete the supplementary curriculum, thereby attaining the degree Bachelor of Science in Agriculture in one year.

PHILIPPINE NORMAL SCHOOL CATEGORIES

Without doubt, the strongest secondary course given in the Philippine Islands is that provided in the Philippine Normal School, an Insular institution located in Manila. The College of Agriculture, itself, was an outgrowth of this institution. The Philippine Normal School provides three curricula: (a) The academic course; (b) The home economics course; (c) The supervising teachers and principals course. The College of Agriculture articulates only with the academic course and that alone will be considered here. The academic course requires completion of the first year of the general high school curriculum for entrance—hence the entire course may be taken as a five-year schedule. The curriculum follows in Table X.[13]

Completion of the Philippine Normal School.—Graduates of the Philippine Normal School academic course form Group VIII and are admitted to the Bachelor of Science curricula conditioned in Mathematics 3, but with advanced standing as follows:

H. S. subjects.	*H. S. units.*	*Credited as*	*C. A. units.*
English IV	10	English 4	5
School management	5		
History of education	5	Elective	20
Practice teaching II	10		

Group VIII should complete the Bachelor of Science curriculum in the regular four years or in three years if they take maximum advantage of the summer sessions.

Completion of fourth year.—Students who have completed with satisfactory ratings the fourth year of the Philippine Normal School, academic course, form Group VIII 4 and are admitted to the Bachelor of Science curriculum conditioned in Mathematics 3, and Physics 1. They should complete the curricula in the usual four years by taking maximum advantage of summer sessions.

Completion of third year.—Students who have completed with satisfactory ratings the third year of the Philippine Normal School form Group VIII 3 and are admitted to the Bachelor of Science curriculum conditioned in Mathmatics 2 and 3, Physics 1 and Rural Economics 1. They should complete the curricula in five years by taking maximum advantage of the summer sessions.

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[13] From the Office of the Superintendent of the Philippine Normal School.

TABLE X.—*Curriculum of the academic course of the Philippine Normal School.*

Year.	Subjects.	Semesters.	Periods a week.[a]	Units.[b]
First..... (General high schools)	English composition H. S. I.....	Both	5	10
	English literature H. S. I.....	Both	4	8
	Current events H. S. I.....	Both	1	2
	United States history.....	Both	3	6
	United States government.....	Both	2	4
	Elementary algebra.....	Both	5	10
	Military drill.....	Both	2	*c*
	Group games and athletics.....	Both	3	*c*
Second.... (First of the P. N. S.)	English I (and current events).....	Both	5	10
	Reading methods and story telling.....	Both	5	10
	General history I.....	Both	5	10
	Physical geography.....	First	5	5
	Geography methods.....	Second	5	5
	Industrial work.....	Both	2+3D[d]	10
	Music I.....	Both	2	
Third..... (Second of the P. N. S.)	English II (and current events).....	Both	5	10
	Drawing.....	Both	5D[d]	10
	Music II.....	Both	3	6
	Writing.....	Both	2	4
	Arithmetic methods.....	Both	5	10
	Biology.....	Both	5D[d]	10
Fourth.... (Third of the P. N. S.)	English III (and current events).....	Both	5	10
	Physiology, hygiene, and sanitation.....	First	5	5
	Philippine history and government.....	Second	5	5
	Psychology.....	First	5	5
	General methods.....	Second	5	5
	Plane geometry.....	Both	5	10
	Observation and practice teaching I.....	Both	5D[d]	10
Fifth..... (Fourth of the P. N. S.)	English IV.....	Both	5	10
	School management.....	First	5	5
	History of education.....	Second	5	5
	Economic conditions.....	Both	5	10
	Physics.....	Both	5D[d]	10
	Practice teaching II.....	Both	5D[d]	10
All.....	All subjects.....	.....	.....	240

[a] Periods are of 40 minutes duration unless otherwise noted.

[b] One period a week for one semester equals one unit.

[c] Informal credit.

[d] D indicates double or laboratory periods of 80 minutes duration but equivalent to one regular period in unit value.

Completion of second year.—Students who have completed with satisfactory ratings the second year of the Philippine Normal School form Group VIII 2 and are admitted to the preparatory curricula with advanced standing as follows:

H. S. subjects.	*H. S. units.*	*Credited as*	*C. A. units.*
English composition H. S. I...	10	English 1.....	10
English P. N. S. I.....	10	English 2.....	10
Elementary algebra.....	10	Mathematics 1.....	10

Group VIII 2 should complete the preparatory curriculum in one year, after which they may enter the Bachelor of Agriculture curriculum which they should complete in the regular four years. All students in Group VIII 2 are registered during the fourth year of their Bachelor of Agriculture curriculum in the supplementary curriculum, thus forming also Group VII 2S. They are given advanced standing in the supplementary curriculum as follows:

H. S.+P. N. S. subjects.	*H. S.+P. N. S. units.*	*Credited as*	*C. A. units.*
English literature I.....	8	Supplementary English.....	10
Current events I.....	2		
United States history.....	6	Supplementary history.....	20
United States government.....	4		
General history I.....	10		
Reading methods and story telling..	10	Supplementary academic.....	20
Physical geography.....	5		
Geography methods.....	5		
Industrial work Music I.....	10	Supplementary technical.....	10

The advanced standing scheduled above amounts to the entire requirement of the supplementary curriculum with the result that Group VII 2S automatically completes the supplementary curriculum simultaneously with the Bachelor of Agriculture curriculum. Consequently Group VIII 2+2S is recommended only for the one degree, Bachelor of Science in Agriculture.

Completion of the first year.—The first year of the academic course in the Philippine Normal School is not given in that institution but consists of the first year of the general high school curriculum, for articulation with which, *see* under Group I 1 on page 498.

SUMMARY OF CATEGORIES

Summarizing all categories, regular and special, Table XI is presented.

CONCLUSIONS

From a review of entrance conditions and advanced standing credits allotted to various groups of matriculants in the College of Agriculture, it is apparent that a complete, though somewhat complex, mechanism has been developed whereby the College may articulate its various curricula with practically every type of secondary school in the Philippine system, with the different years thereof and with the intermediate schools.

The broad entrance policy in the College has been maintained with the constant end in view of popularizing agricultural technical education without lowering the collegiate standards.

Upper-end articulation of the College, as well as the adopted standards, have been maintained in the College by virtue of the supplementary curriculum which forms the elastic element in what would otherwise be a very rigid set of curricula.

TABLE XI.—*Summary of categories of students admitted to the College of Agriculture with their conditions and advanced standing credits.*

Group.	Received from:			College of Agriculture curriculum to which admitted.	Conditioned in:		Advanced standing in:		Degree conferred.
	Institution.	Course.	Yrs.		Subjects.	Units.	Subjects.	Units.	
I	High school	General	4	Bachelor of Science					Bachelor of Science in Agriculture.
I–ST	High school	General	4	Sugar Technology					Bachelor of Science in Agriculture with Certificate in Sugar Technology.
I–3	High school	General	3	Bachelor of Science	Physics 1 Rural economics 1	6 4			Bachelor of Science in Agriculture.
I–2	High school	General	2	Preparatory			English 1, 2 Mathematics 1, 2	20 20	
	College of Agriculture	Prep.	2	Bachelor of Agriculture					Bachelor of Agriculture.
I–2S	College of Agriculture ex 2nd yr. general	B. Agr.	4	Supplementary			English History Academic	10 20 10	Bachelor of Science in Agriculture.
I–1	High school	General	1	Preparatory			English 1 Mathematics 1	10 10	
	College of Agriculture	Prep.	2	Bachelor of Agriculture					Bachelor of Agriculture.
I–1S	College of Agriculture ex 1st yr. general	B. Agr.	4	Supplementary			English History	10 10	Bachelor of Science in Agriculture.
II	Intermediate school	All	3	Preparatory.					
	College of Agriculture	Prep.	2	Bachelor of Agriculture					Bachelor of Agriculture.
II–S	College of Agriculture ex intermediate	B. Agr.	4	Supplementary					Bachelor of Science in Agriculture.
III	High school	Agric.	4	Bachelor of Science	Mathematics 1, 2, 3 Physics 1	25 6	Agronomy 1 Farm experience A, B, C	4 a	Bachelor of Science in Agriculture.
III–3	High school	Agric.	3	Bachelor of Science	Mathematics 1, 2, 3 Physics 1 Rural economics 1	25 6 4	Agronomy 1 Farm experience A, B, C	4 a	Bachelor of Science in Agriculture.
III–2	High school	Agric.	2	Preparatory			English 1, 2 Plant Physiology 1 Agronomy 1 Farm experience A, B, C	20 8 4 a	
	College of Agriculture	Prep.	2	Bachelor of Agriculture					Bachelor of Agriculture.
III–2S	College of Agriculture ex 2nd yr. agricultural	B. Agr.	4	Supplementary			Academic Technical	10 10	Bachelor of Science in Agriculture.

III–1	High school	Agric.	1	Preparatory			English 1	10	
							Agronomy 1	4	
							Farm experience A, B, C	a	
	College of Agriculture	Prep.	2	Bachelor of Agriculture					Bachelor of Agriculture.
III–1S	College of Agriculture ex 1st yr. agricultural	B. Agr.	4	Supplementary			Academic	10	Bachelor of Science in Agriculture.
IV	High school	Commercial.	4	Bachelor of Science	Mathematics 3	5			Bachelor of Science in Agriculture.
					Plant Physiology 1	8			
					Physics 1	6			
IV–3	High school	Commercial.	3	Bachelor of Science	Mathematics 3	5			Bachelor of Science in Agriculture.
					Plant Physiology 1	8			
					Physics 1	6			
					Rural economics 1	4			
V	High school	Trade	4	Bachelor of Science	Plant Physiology 1	8	Mathematics 5, 6	6	Bachelor of Science in Agriculture.
							Farm experience B, C	a	
V–3	High school	Trade	3	Bachelor of Science	Plant Physiology 1	8	Farm experience B, C	a	Bachelor of Science in Agriculture.
					Physics 1	6			
					Rural economics 1	4			
V–2	High school	Trade	2	Preparatory			English 1, 2	20	
							Mathematics 1, 2	20	
							Farm experience B, C	a	
	College of Agriculture	Prep.	2	Bachelor of Agriculture					Bachelor of Agriculture.
V–2S	College of Agriculture ex 2nd yr. trade	B. Agr.	4	Supplementary			English	10	Bachelor of Science in Agriculture.
							History	10	
							Technical	10	
V–1	High school	Trade	1	Preparatory			English 1	10	
							Mathematics 1	10	
							Farm experience B, C	a	
	College of Agriculture	Prep.	2	Bachelor of Agriculture					Bachelor of Agriculture.
V–1S	College of Agriculture ex 1st yr. trade	B. Agr.	4	Supplementary			English	10	Bachelor of Science in Agriculture.
VI–2	High school	2-Yr. Normal.	2	Preparatory			English 1, 2	20	
	College of Agriculture	Prep.	2	Bachelor of Agriculture					Bachelor of Agriculture.
VI–2S	College of Agriculture ex 2nd yr. 2-yr. normal	B. Agr.	4	Supplementary			English	10	Bachelor of Science in Agriculture.
							History	10	
							Academic	30	
VI–1	High school	2-Yr. Normal.	1	Preparatory			English 1	10	
	College of Agriculture	Prep.	2	Bachelor of Agriculture					Bachelor of Agriculture.
VI–1S	College of Agriculture ex 1st yr. 2-yr. normal	B. Agr.	4	Supplementary			English	10	Bachelor of Science in Agriculture.
							History	10	
							Academic	10	
							Technical	10	

				culture	Physics 1	5			culture.
VII–3	High school	4-Yr. Normal	3	Bachelor of Science in Agriculture	Mathematics 2, 3 Physics 1 Rural economics 1	15 6 4			Bachelor of Science in Agriculture.
VII–2	High school	4-Yr. Normal	2	Preparatory			English 1, 2 Mathematics 1	20 10	
	College of Agriculture	Prep	2	Bachelor of Agriculture					Bachelor of Agriculture.
VII–2S	College of Agriculture ex 2nd yr. 4-yr. normal	B. Agr.	4	Supplementary			English History Academic Technical	10 20 20 10	Bachelor of Science in Agriculture.
VII–1	High school	4-Yr. Normal	1	Preparatory			English 1	10	
	College of Agriculture	Prep	2	Bachelor of Agriculture					Bachelor of Agriculture.
VII–1S	College of Agriculture ex 1st yr. 4-yr. normal	B. Agr.	4	Supplementary			English History Academic Technical	10 10 10 10	Bachelor of Science in Agriculture.
VIII	Philippine Normal School	5-Yr. Normal	5	Bachelor of Science in Agriculture	Mathematics 3	5	English 4 Elective	5 20	Bachelor of Science in Agriculture.
VIII–4	Philippine Normal School	5-Yr. Normal	4	Bachelor of Science in Agriculture	Mathematics 3 Physics 1	5 6			Bachelor of Science in Agriculture.
VIII–3	Philippine Normal School	5-Yr. Normal	3	Bachelor of Science in Agriculture	Mathematics 2, 3 Physics 1 Rural economics 1	15 6 4			Bachelor of Science in Agriculture.
VIII–2	Philippine Normal School	5-Yr. Normal	2	Preparatory			English 1, 2 Mathematics 1	20 10	
	College of Agriculture	Prep	2	Bachelor of Agriculture					Bachelor of Agriculture
VIII–2S	College of Agriculture ex 2nd yr. P. N. S.	B. Agr.	4	Supplementary			English History Academic Technical	10 20 20 10	Bachelor of Science in Agriculture.

a Informal credit.